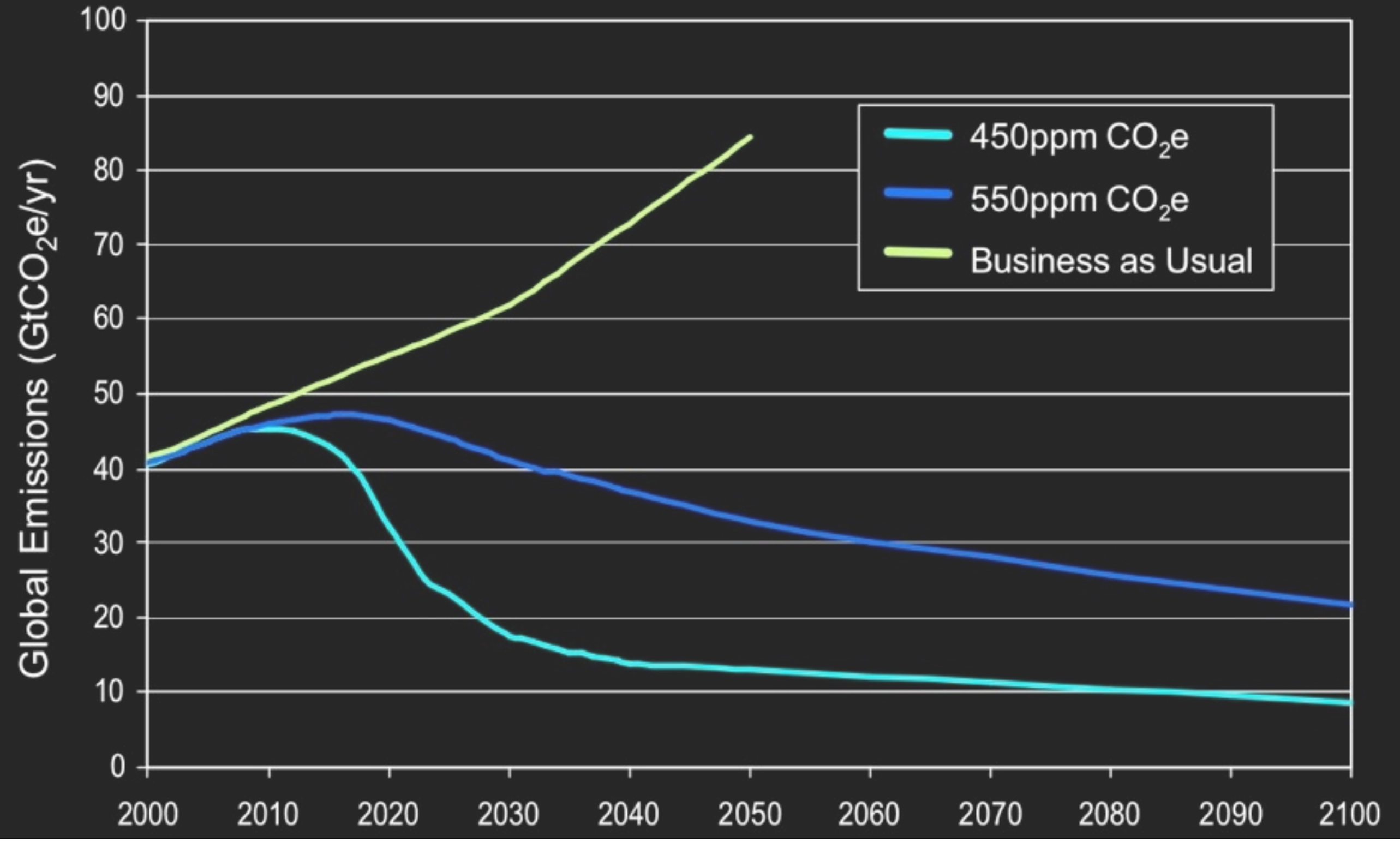
making retrofit deliver



who thinks we can get off that green line

urbed

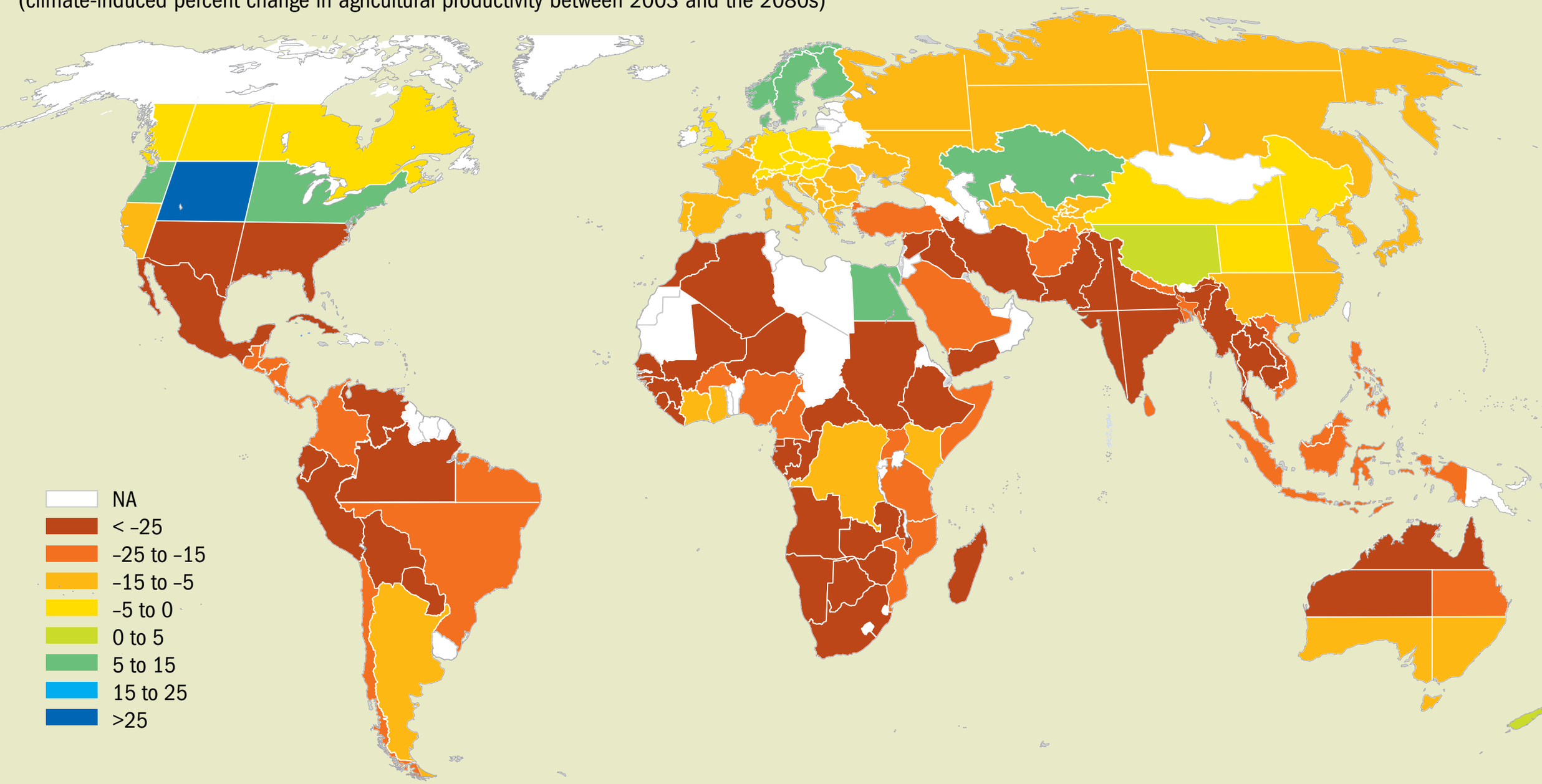
adapt to this then...

Map 1

Without carbon fertilization

If there are no beneficial effects from increased carbon dioxide, agricultural output declines almost everywhere and catastrophically closer to the equator.

(climate-induced percent change in agricultural productivity between 2003 and the 2080s)



Source: Cline (2007).

Note: NA refers to “not applicable” for Alaska and northern Canada, and to “not available” elsewhere.

we’re also one of the major emitters...

map proportional to 2000 CO2 emissions

urbed

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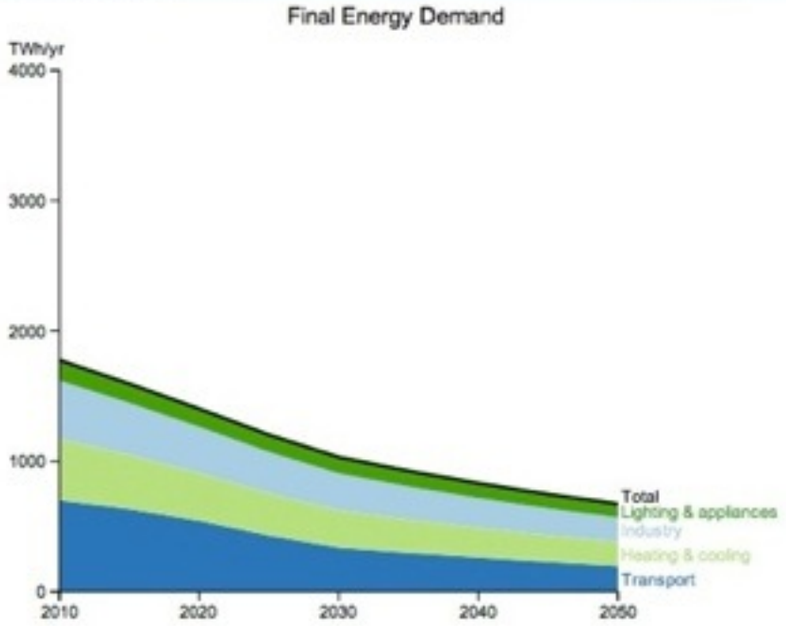
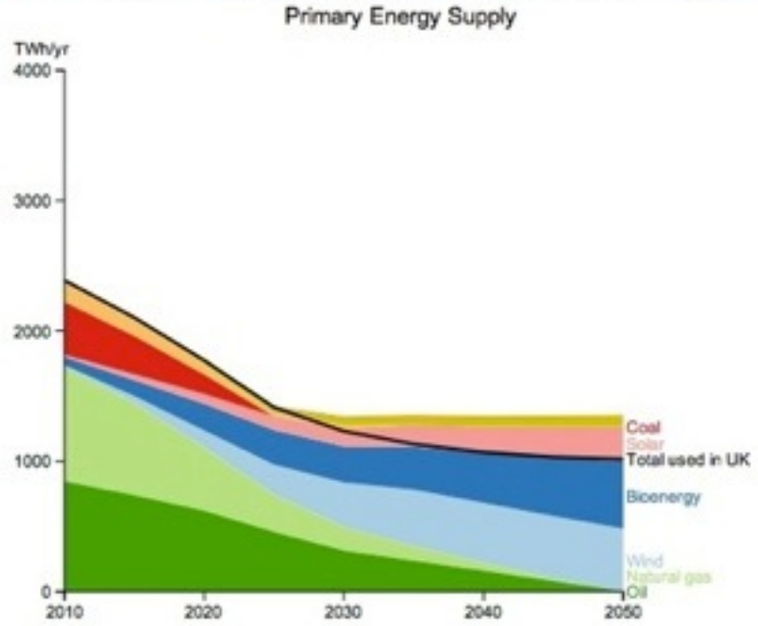
there’s a lot of room for improvement (& growth)

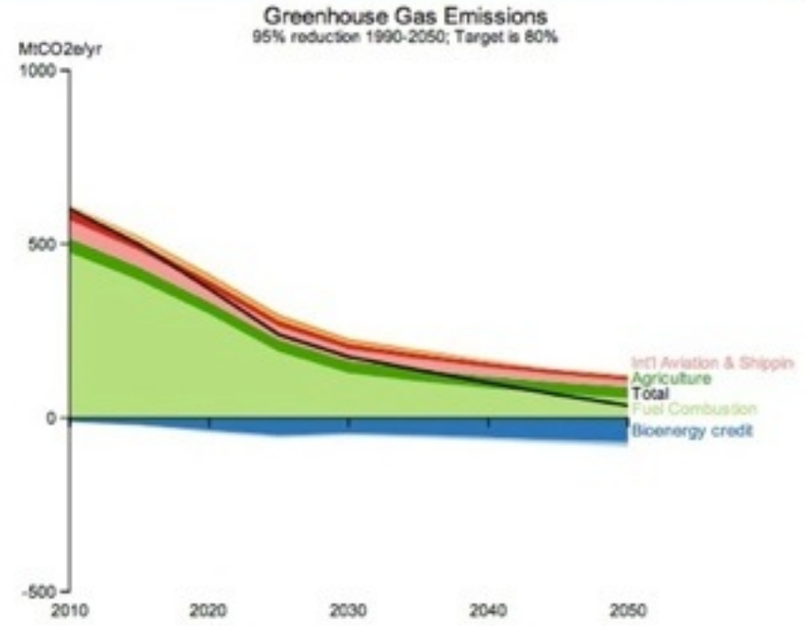
map proportional to decrease in CO2 emissions

urbed

CarbonCo–op







Cumulative emissions: 9529 MtCO2e

Percentage of CCC pathway's cumulative emissions: 100%

Exceeds CCC intended carbon budget!

Domestic transport behaviour	? 1 2 3 4
Shift to zero emission transport	? 1 2 3 4
Choice of fuel cells or batteries	? 1 2 3 4
Domestic freight	? 1 2 3 4
International aviation	? 1 2 3 4
International shipping	? 1 2 3 4
Average temperature of homes	? 1 2 3 4
Home insulation	? 1 2 3 4
Home heating electrification	? A B C D
Home heating that isn't electric	? A B C D
Home lighting & appliances	? 1 2 3 4
Electrification of home cooking	? A B
Growth in industry	? A B C
Energy intensity of industry	? 1 2 3
Commercial demand for heating and cooling	? 1 2 3 4
Commercial heating electrification	? A B C D
Commercial heating that isn't electric	? A B C D
Commercial lighting & appliances	? 1 2 3 4
Electrification of commercial cooking	? A B

Nuclear power stations	? 1 2 3 4
CCS power stations	? 1 2 3 4
CCS power station fuel mix	? A B C D
Offshore wind	? 1 2 3 4
Onshore wind	? 1 2 3 4
Wave	? 1 2 3 4
Tidal Stream	? 1 2 3 4
Tidal Range	? 1 2 3 4
Biomass power stations	? 1 2 3 4
Solar panels for electricity	? 1 2 3 4
Solar panels for hot water	? 1 2 3 4
Geothermal electricity	? 1 2 3 4
Hydroelectric power stations	? 1 2 3 4
Small-scale wind	? 1 2 3 4
Electricity imports	? 1 2 3 4
Land dedicated to bioenergy	? 1 2 3 4
Livestock and their management	? 1 2 3 4
Volume of waste and recycling	? A B C D
Marine algae	? 1 2 3 4
Type of fuels from biomass	? A B C D
Bioenergy imports	? 1 2 3 4

Geosequestration	? 1 2 3 4
Storage, demand shifting & interconnection	? 1 2 3 4

- consumer-led demand reduction
- rippling out across all sectors
- requires much less new energy generation

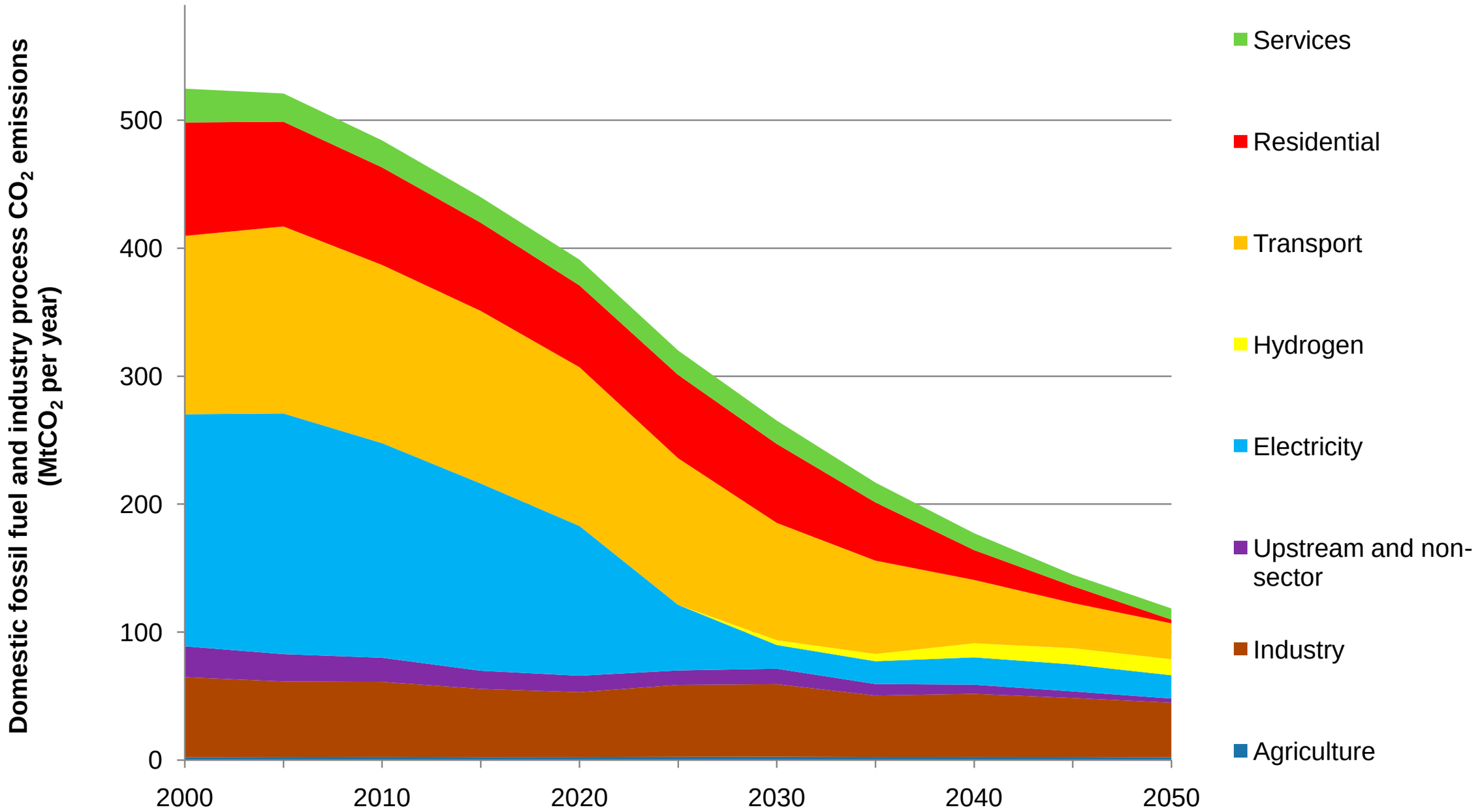
http://2050.hellings.webfactional.com

urbed

CarbonCo-op

our housing has a big role to play...

Figure 2.29 UK sectoral CO_2 emissions to 2050 on an 80% emissions reduction path (MARKAL)



Source: MARKAL modelling based on CCC assumptions (2008).

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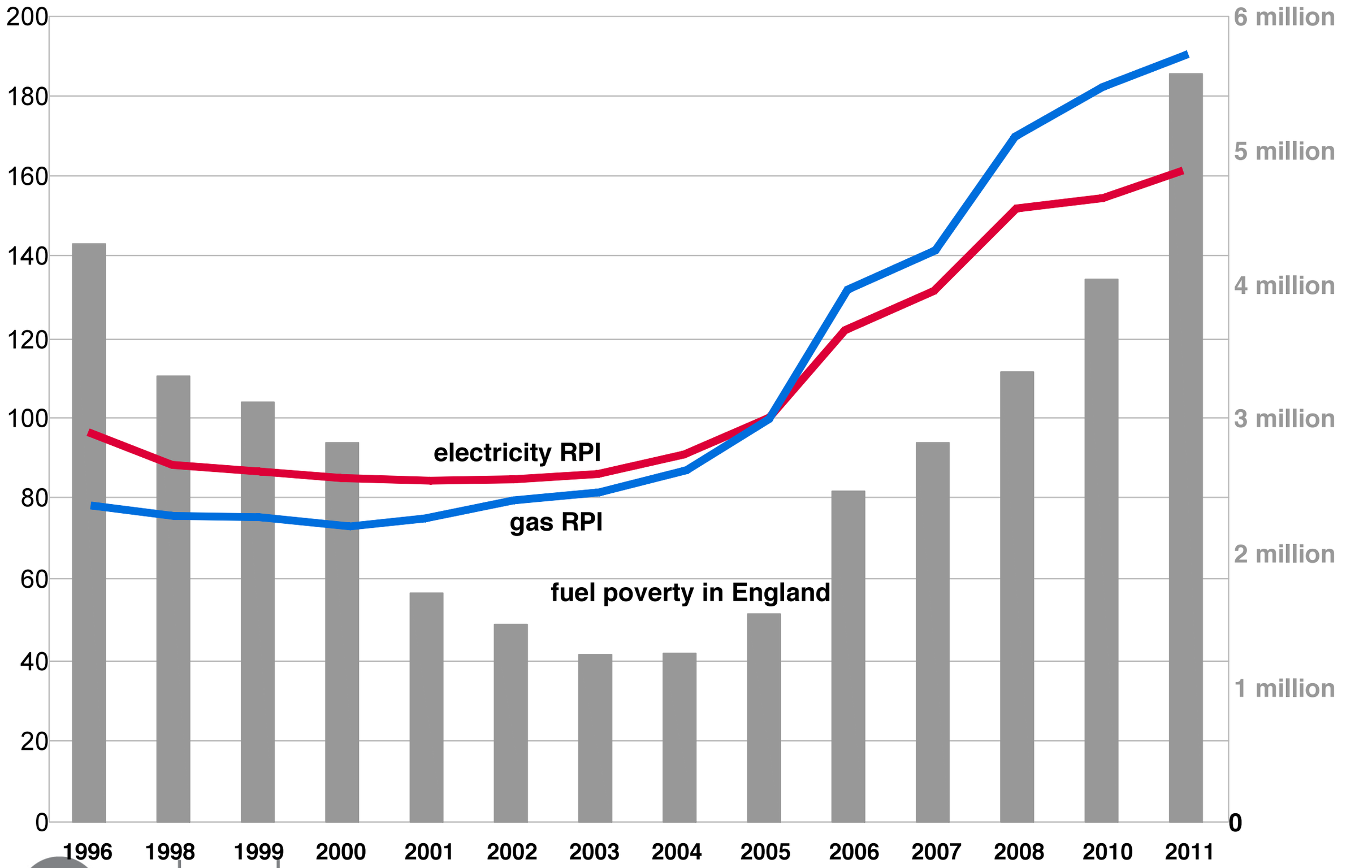
CarbonCo–op

and fuel poverty is one of the political priorities



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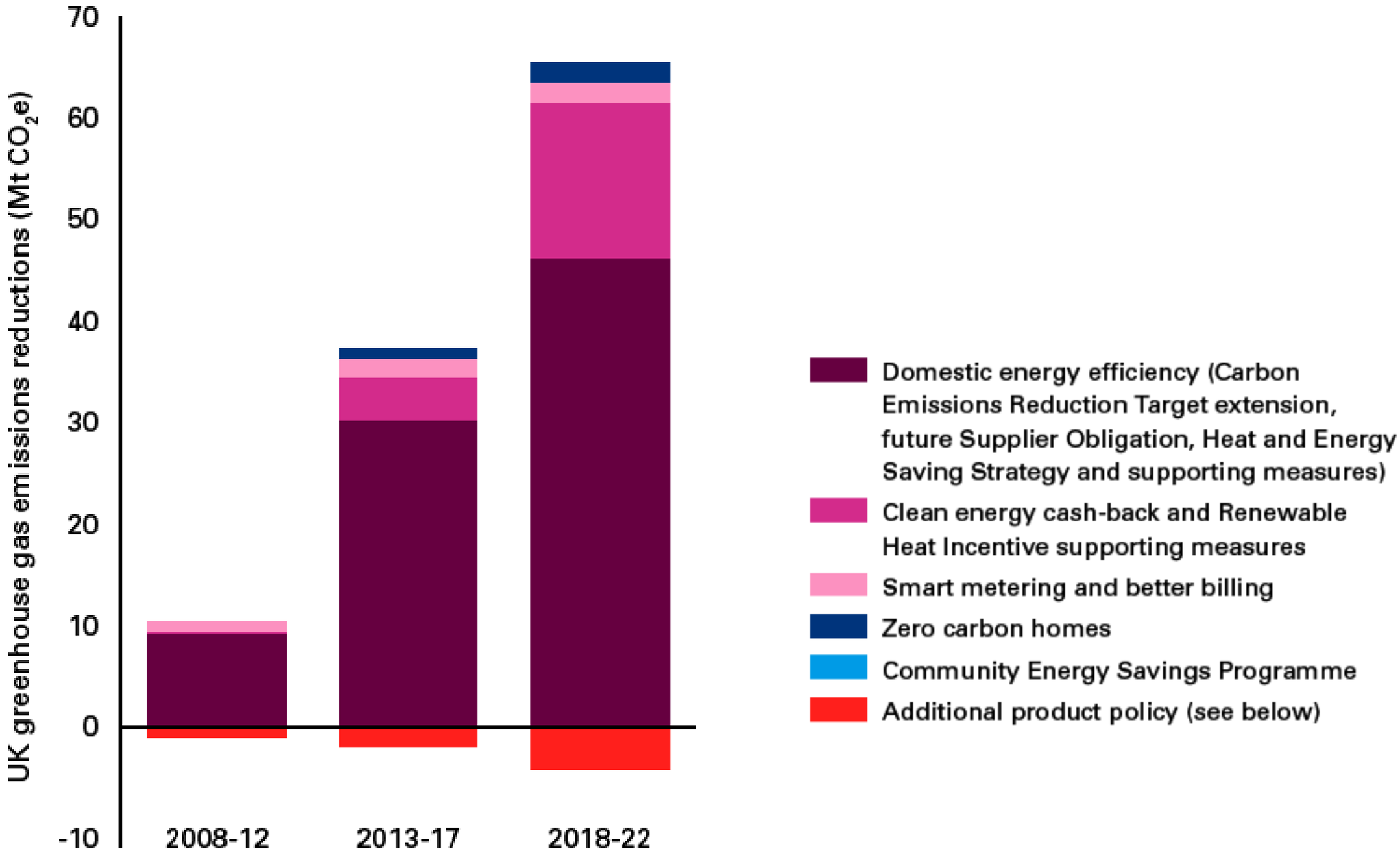
CarbonCo-op

- 27 million homes
- every pre-1990 home will require carbon reduction measures
- 85% of today's homes will still be standing in 2050

we need to hit the mass-market …

…the equivalent of a city the size of Cambridge every month

and it's mostly about energy efficiency



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CarbonCo–op

start with demonstration show houses

Climate protection concept Neumarkt i. d. Oberpfalz

Thanks to Dr. Burkhard Schulze-Darup

use monitors to identify what & where 1st

Climate protection concept Neumarkt i. d. Oberpfalz

Pri
energy

Heating
Warmwa
kWh

>300
250
200
175
150
125
100
75
50
25
0
-25
-50

Thanks to Dr. Burkhard Schulze-Darup

then deliver retrofits at a neighbourhood scale

Climate protection concept Neumarkt i. d. Oberpfalz

Pri
energy

Heating
Warmwa
kWh

>300
250
200
175
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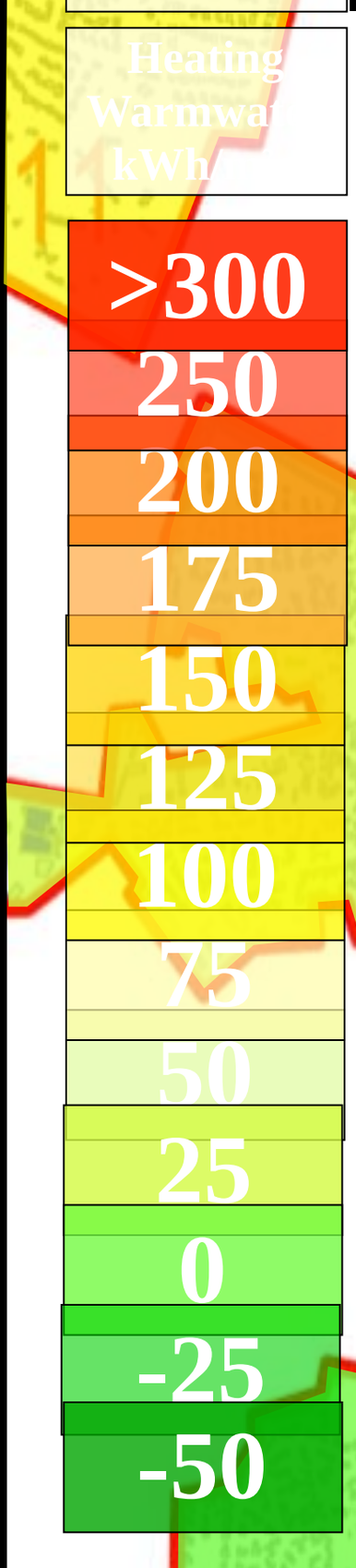
kWh



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Heating
Warmwa
kWh

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200
175
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125
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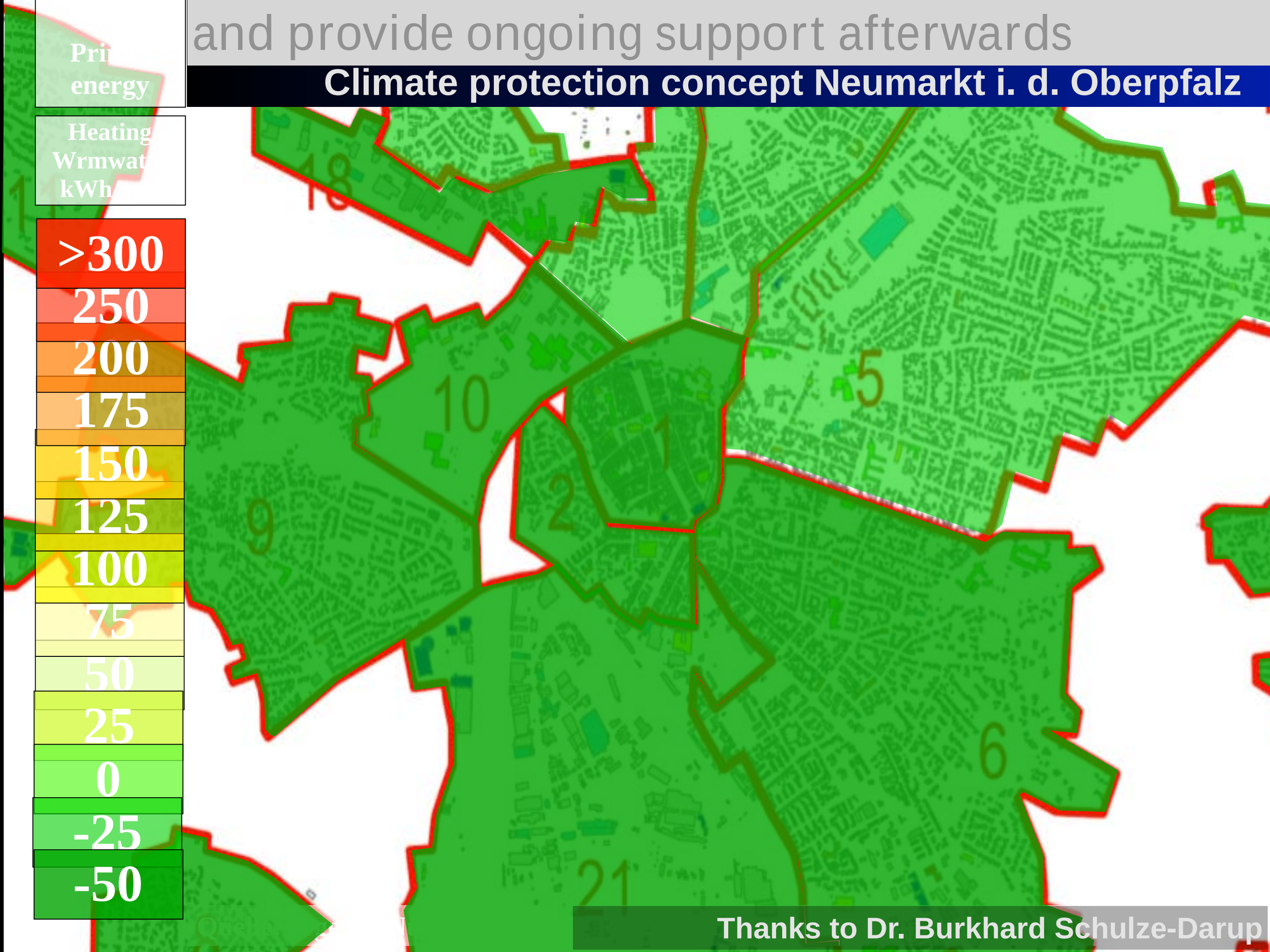
75
50
25
0
-25
-50

Thanks to Dr. Burkhard Schulze-Darup

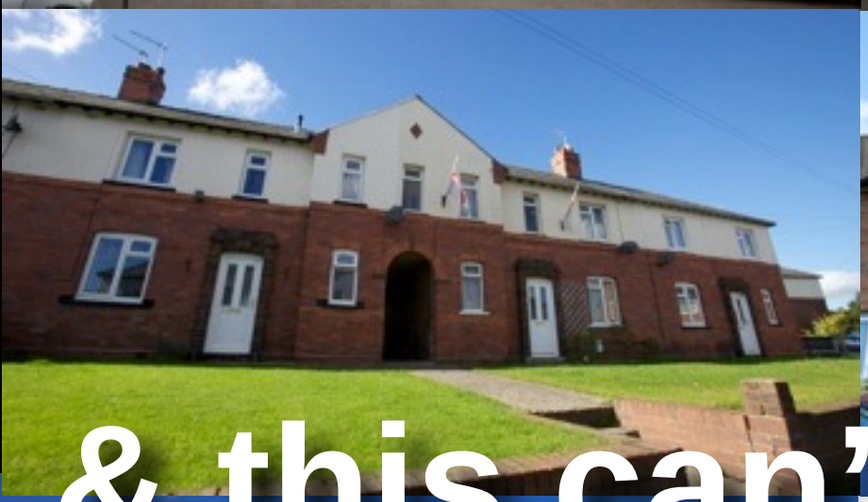
and provide ongoing support afterwards

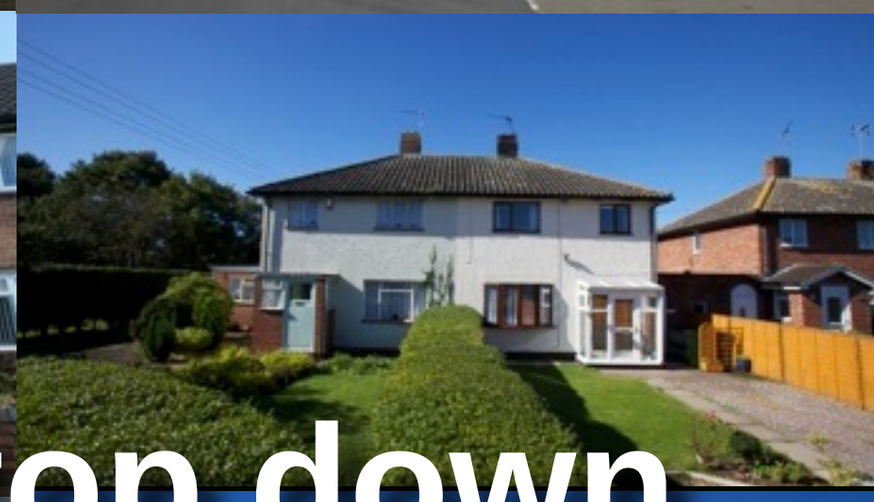
Climate protection concept Neumarkt i. d. Oberpfalz



Thanks to Dr. Burkhard Schulze-Darup





& this can't be done top down






ordinary people, their different lifestyles + homes

some will accept change but not disruption

but some people just don't want to be disturbed

measures can be used to improve the health of the occupants

superhome.urbed.coop
2006-

we started here

there’s 4 million of them

replaced old glass
with double glazing

replaced old beads
with pre-installed
draft seals

replaced rotten
casements

secondary glazed
stained glass


if you put new
windows in, make
them triple glazed
and well sealed

insulate on the
outside where you
can

stainless steel
reveal

200mm of external wall insulation where you can manage it

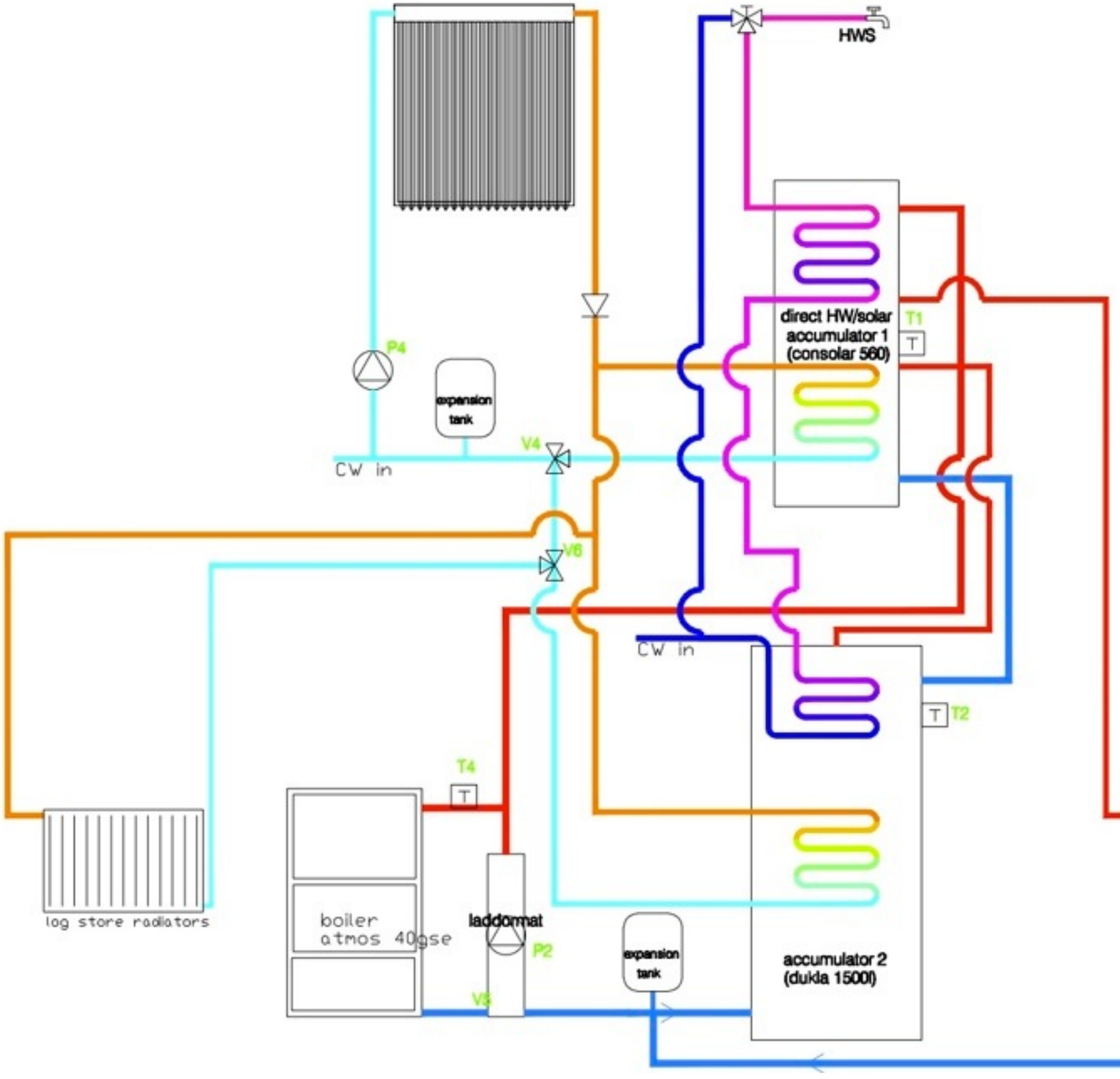
put insulation where you can.
here, the ground floor

CarbonCo-op

fit solar panels to the roof

it can be complicated:

here, a combined wood and solar thermal system



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with a gasifying log burner

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but the logistics of fuel supply + storage are major
you will only want to do this once
you've reduced demand...a lot

& there’s a lot of plumbing

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and the plumbing
can be very big

although
paying nothing for
hot water is nice
& it does work

CarbonCo-op

only
insulate
internally
if you
can't do it
externally

CarbonCo-op

because
it’s very messy
and disruptive

reroofing is quite a task and quite a lot of money

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you have to be
prepared for things
to fall off

bay windows are not easy

joist ends need to be considered when sat the other side of IWI

internal wood fibre which can cope with uneven surface

urbed

urbed

CarbonCo–op

we took a 220 sq.m
house,
made it warm
reduced gas use to 0,
electricity by 30%
CO_2 by 84%

cost: £44,000

CarbonCo-op

Beyond Decent Homes
SHAP 2009

www.shap.uk.com/reports

performance metrics

Capital cost	£32,236.58
by floor area	£393.13/m²

Performance metrics	**1990**	**2009**	**2025**
SAP rating	53 (E)	72 (C)	93 (A)
Fuel cost	£661.84	£540.29	£239.05
CO_2 emissions	7.6	4.6	1.5
% reduction	- 0%	-39%	-81%

Fabric U-Values	**Baseline 1990**		**As of 2009**		**Target 2025**	
	U Value W/m²K	Heat loss W/m	U Value W/m²K	Heat loss W/m	U Value W/m²K	Heat loss W/m
Windows	4.0	50.9	2.5	31.8	0.7	8.9
Doors	3.9	14.7	3.0	11.3	1.2	4.5
Floor	0.7	29.0	0.7	29.0	0.4	18.0
Walls	2.5	191.7	0.7	50.2	0.2	13.9
Roof	1.8	73.8	0.4	16.1	0.1	4.2

Energy and CO_2 emissions	kWh	CO_2 (tonnes)	kWh	CO_2 (tonnes)	kWh	CO_2 (tonnes)
Space heating	28,085	5.4	11,876	2.3	1,672	0.3
Hot water	4,753	0.9	4,753	0.9	944	0.2
Electricity	2,995	1.3	3,304	1.4	2,281	1.0

the base specification:

loft insulation to 400mm

external wall insulation

floor insulation

new triple glazing

solar hot water

better use data + controls

Case study 1
Perry Street, Darlaston

Pre-1945 terrace

Case study 8
Birchcroft, Smethwick
Archetype
High rise flats

performance metrics

Capital cost	£16,371.26
by floor area	£218.28/m²

Performance metrics	**1990**	**2009**	**2025**
SAP rating	45 (E)	70 (C)	93 (A)
Fuel cost	£647.90	£411.66	£183.39
CO_2 emissions	5.4	3.8	1.1
% reduction	- 0%	-29%	-81%

Fabric U-Values	**Baseline 1990**		**As of 2009**		**Target 2025**	
	U Value W/m²K	Heat loss W/m	U Value W/m²K	Heat loss W/m	U Value W/m²K	Heat loss W/m
Windows	4.0	40.2	2.5	24.8	0.7	6.9
Doors	3.0	11.0	3.0	10.7	1.2	4.3
Walls	1.3	48.4	0.7	24.7	0.2	8.5

Energy and CO_2 emissions	kWh	CO_2 (tonnes)	kWh	CO_2 (tonnes)	kWh	CO_2 (tonnes)
Space heating	7,563	3.2	4,242	1.8	476	0.1
Hot water	3,196	1.3	2,963	1.3	2,074	0.4
Electricity	2,034	0.9	1,858	0.8	1,311	0.6

external wall insulation

new triple glazing

communal ventilation heat recovery

communal heating/ hot water main supplied by solar panels + communal boiler

better use data + controls

Retrofit for the Future with Bramall's 2010

we looked at tailor made solutions to achieve the target

rotherham								
	walls, roof, doors	electrical	floor insulation	windows	ventilation	heating	solar kit	appliances
237	external wall insulation, loft build up + insulated doors	low flow taps, showers + wc's smart meters, real time display in house. CFL's.	external floor insulation	replace glazing only if not external beaded new hardwood triple glazed windows	Passive vent	gas	photo-voltaic	A++
239					MVHR	gas	solar thermal	A++
241					Passive vent underfloor pre-heat	biomass	solar thermal	A++
251					existing natural	gas	photo-voltaic	existing retained
253					Passive vent	biomass	solar thermal	A++
255					MVHR	gas	photo-voltaic	A++

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windows

- new windows set into insulation

urbed

walls

- applied insulation before rendering

urbed

CarbonCo–op

walls & foundations

- perimeter insulation down to foundations
- everything had to be moved, above and below ground

urbed

CarbonCo–op

floor insulation solution #1

- an experimental solution for suspended floors
- Misapor applied directly to top of ground with unventilated airgap above

urbed

floor insulation solution #2

- glass wool batts on plastic webbing
- ...or on chicken wire
- new floor boards on top

urbed

walls - roof

- very little space for insulation at eaves
- had to use spacetherm to preserve ventilation beneath felt
- thickness of wall insulation meant roof had to be extended
- most likely position for cold bridging

urbed

fts

- original roof spaces had about 100mm glass wool
- used as storage
- efficiency of insulation affected

- 400mm deep
- needs to retain tenant storage
- secondary

urbed

lofts

tried out 2 different insulants:

- glass wool - no longer formaldehyde bonded.
- blown recycled newspaper
- loft hatches got a lot bigger + had to be moved

urbed

solar thermal

half the properties have solar thermal arrays

urbed

the other half have photo-voltaic arrays, sized to meet emission

urbed

heating + hot water

- as a result of different smoke control laws here to the rest of europe, very few manufacturers make a permissible woodburner that will heat hot water too

- we tried one german one and one english one
- one was 4 x the price of the other

thermal stores...

- UK heating systems are totally different to european ones
- ours are vented, theirs are unvented or pressurised
- vented is however a lot cheaper but the product range is very limited
- this is the english one, which at least fits inside the house!

urbed

heat store + pump equipment for solar tubes

- there's a lot of equipment to fit in for a good sized (unvented) store.
- where possible we used original coal stores

CarbonCo–op

- exhaust airsource heat pump!
- contractor designed?

rotherham								
	walls, roof, doors	electrical	floor insulation	windows	ventilation	heating	solar kit	appliances
237	external wall insulation, loft build up + insulated doors	low flow taps, showers + wc's smart meters, real time display in house. CFL's.	internal floor insulation	new hardwood triple glazed windows	Passive vent	gas	photo-voltaic	A++
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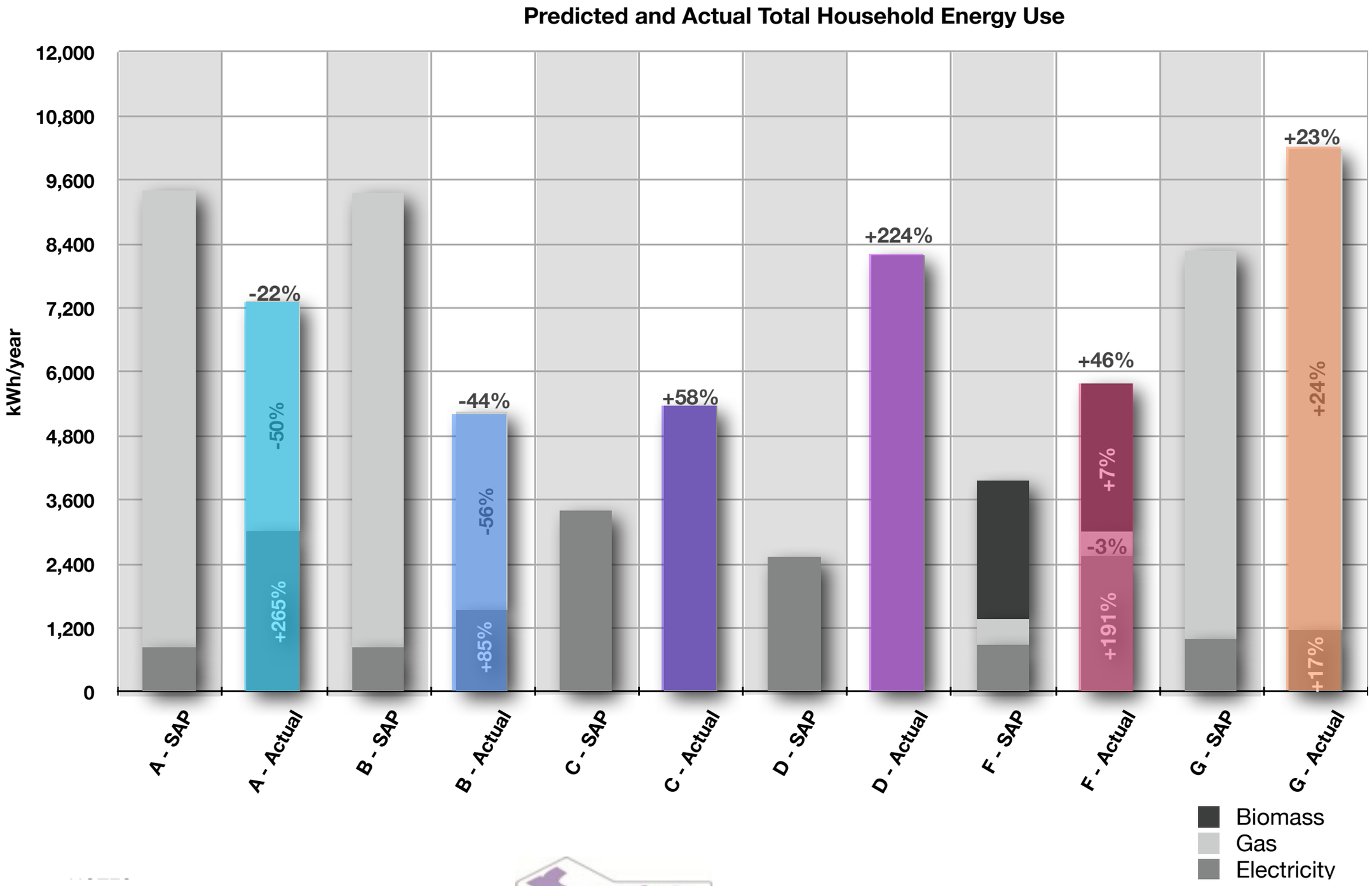
253					Passive vent	biomass	solar thermal	A++
255					MVHR	gas	photo-voltaic	A++

tailor made solutions to achieve the target:

17kgs CO_2/per square metre/year
120kWh/m^2/A

and most of them worked...



urbed

refurb rethink retrofit awards 2011 highly commended

sustain SUSTAINABILITY, BUSINESS & THE BUILT ENVIRONMENT MAGAZINE AWARDS 2011 WINNER

TSB Retrofit Revealed Report 2013

urbed

CarbonCo-op

acting locally
can deliver globally

CarbonCo-op

people powered
not fossil fuelled

community control & a real community bond

A Carbon Co-op

'A membership-based business that aims to support households to achieve significant reductions in their carbon emissions that would be difficult to achieve on their own.

3—

The Carbon Co-op Manual
Moss Side Edition — April 2010

How to use this booklet

This booklet is a practical guide to help Manchester residents make savings on energy bills and reduce their carbon emissions at the same time. There are 8 sections, each one includes:

Answers information, facts & figures to answer questions and doubts, as well as good reasons to take the actions suggested.

Examples of what other residents and communities just like us have done to reduce their energy use, bills and carbon foot print - and how they have gone about it.

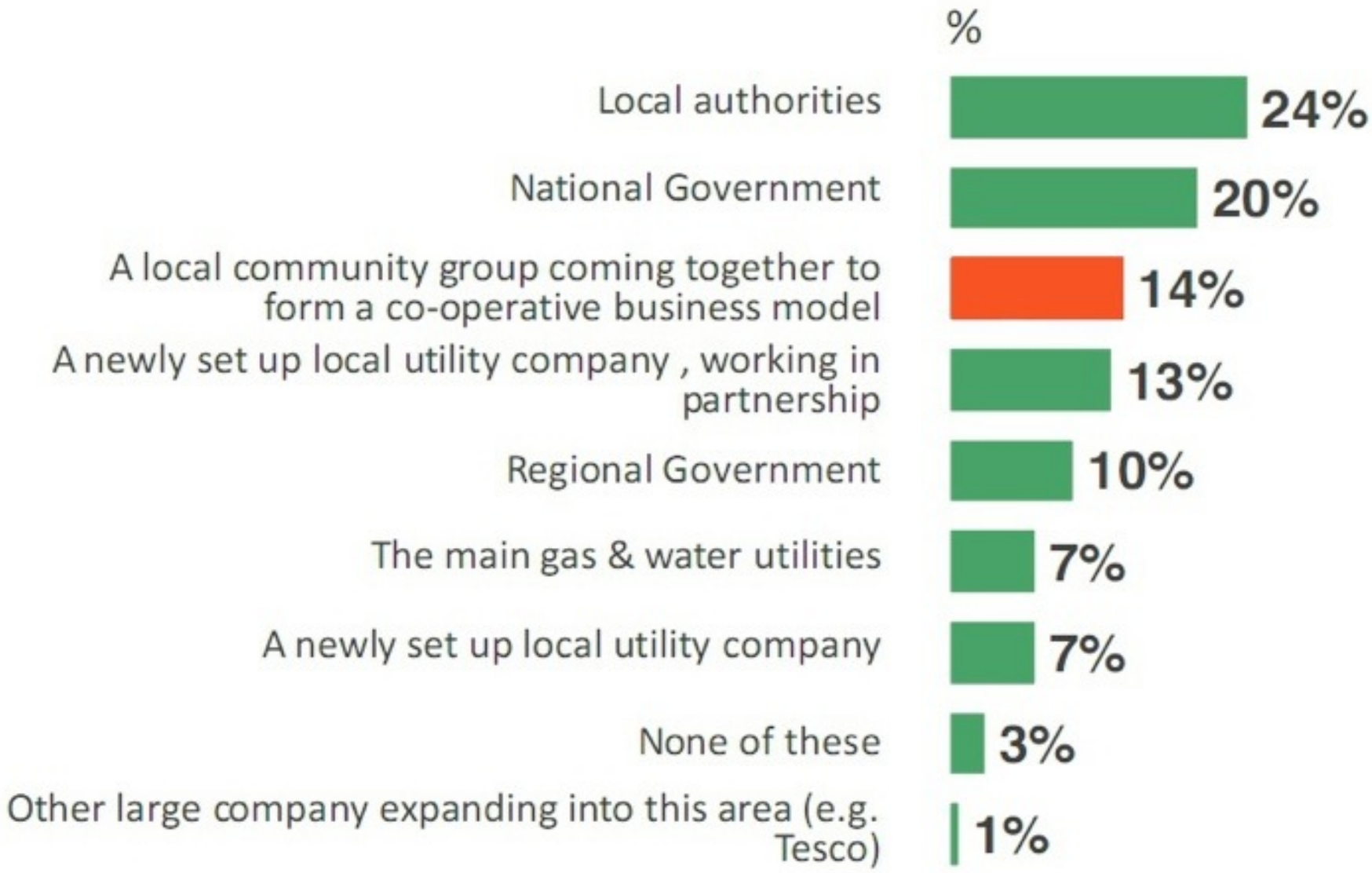
Actions practical guidance on what needs doing and how to get started - so if you want to know how to get on and do it, look for the actions in each section.

The Carbon Co-op
Phone 0161 408 6492
Web www.carbon.coop
Email info@carbon.coop

- set up in june 2011 after 2 years of pilot work

to deliver trust & accountability

Q. Which <u>one</u> of the following groups, if any, do you think should be responsible for leading on the idea of sustainable community infrastructure?

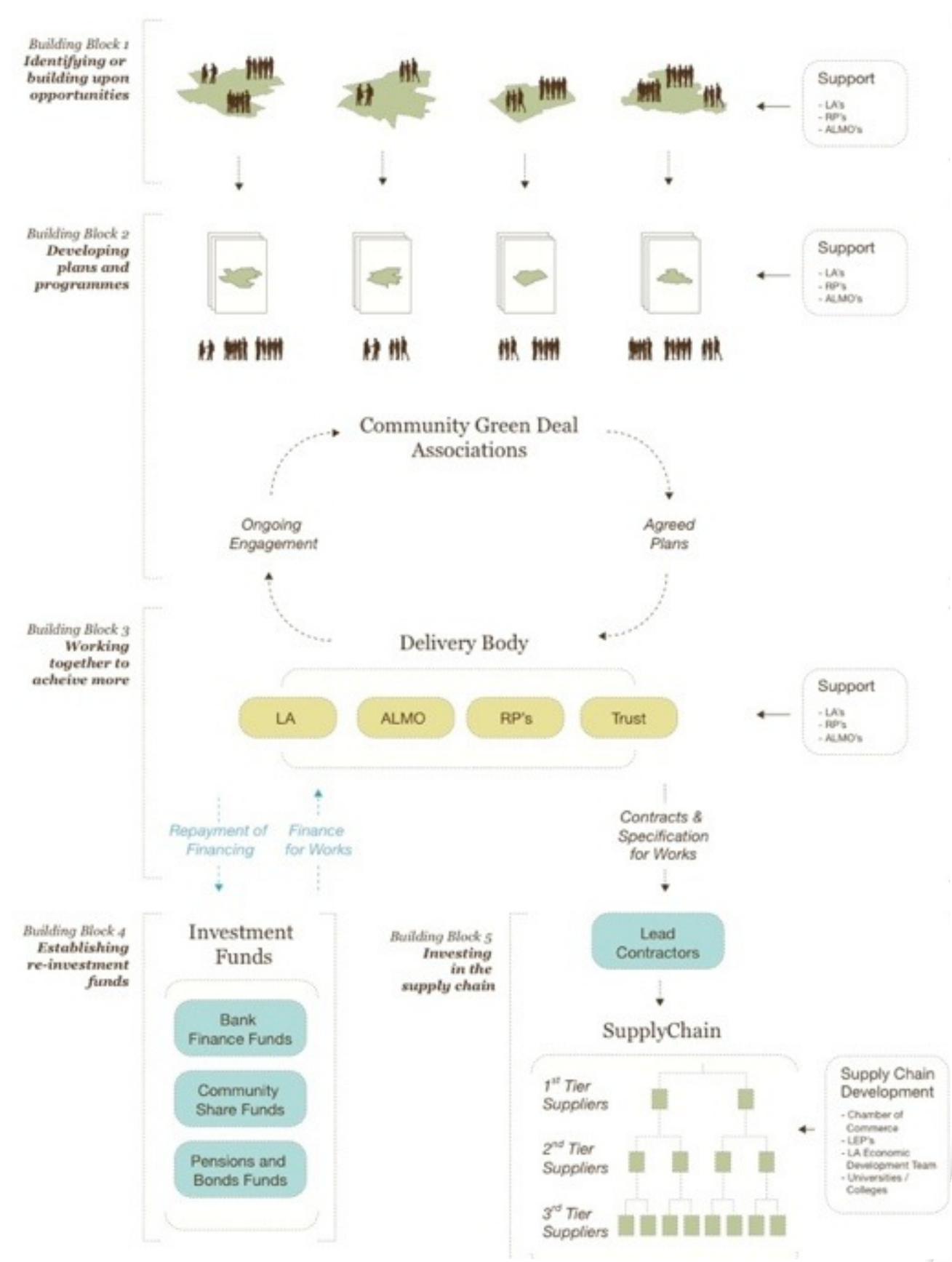


Base: 1,074 GB adults aged 18+, interviewed online, Ipsos MORI, October 2009

icaro consulting

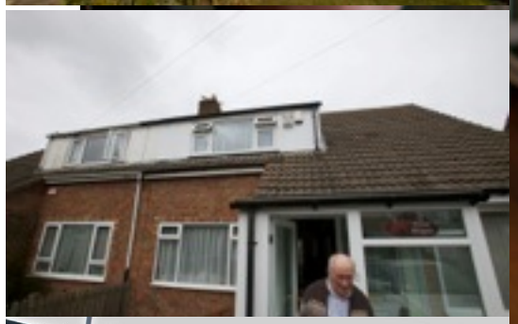
urbed

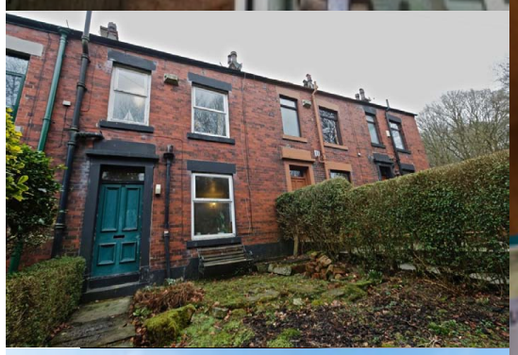
CarbonCo-op


Building Block 1
Identifying or building upon opportunities
Support
- LA's
- RP's
- ALMO's
Building Block 2
Developing plans and programmes
Support
- LA's
- RP's
- ALMO's
Community Green Deal Associations
Ongoing Engagement
Agreed Plans
Delivery Body
Building Block 3
Working together to acheive more
LA
ALMO
RP's
Trust
Support
- LA's
- RP's
- ALMO's
Repayment of Financing
Finance for Works
Contracts & Specification for Works
Building Block 4
Establishing re-investment funds
Investment Funds
Bank Finance Funds
Community Share Funds
Pensions and Bonds Funds
Building Block 5
Investing in the supply chain
Lead Contractors
SupplyChain
1st Tier Suppliers
2nd Tier Suppliers
3rd Tier Suppliers
Supply Chain Development
- Chamber of Commerce
- LEP's
- LA Economic Development Team
- Universities / Colleges


Community Green Deal
Developing a model to benefit whole communities
Final report and companion guides
SHAP
sustainable housing action partnership
Homes & Communities Agency

urbed





whole house assessment method

urbed

CarbonCo–op

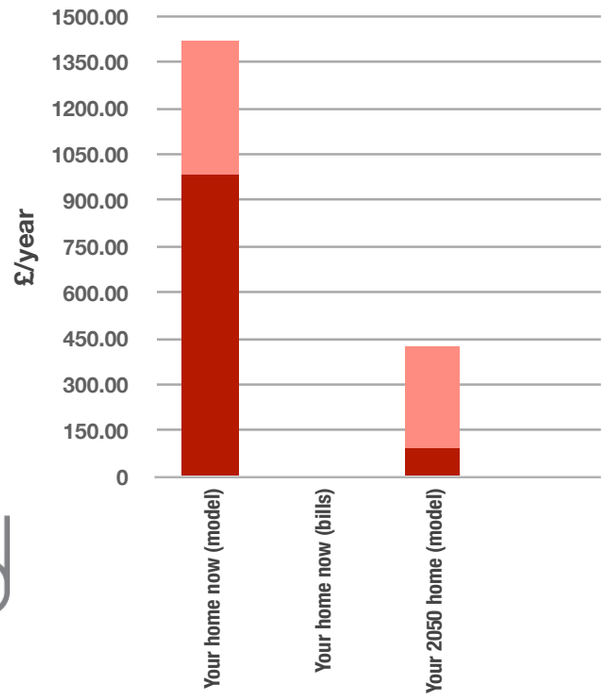
building the tool

- ‘open source’ SAP (standard assessment procedure) spreadsheet tool
- allows immediate feedback on adjustments

urbed

householder reports

- important tool for communication
- in a process of feedback and continuous improvement
- implications of under-heating for financing
- other reasons for retrofit - comfort, ethics, property value
- exploring interim measures



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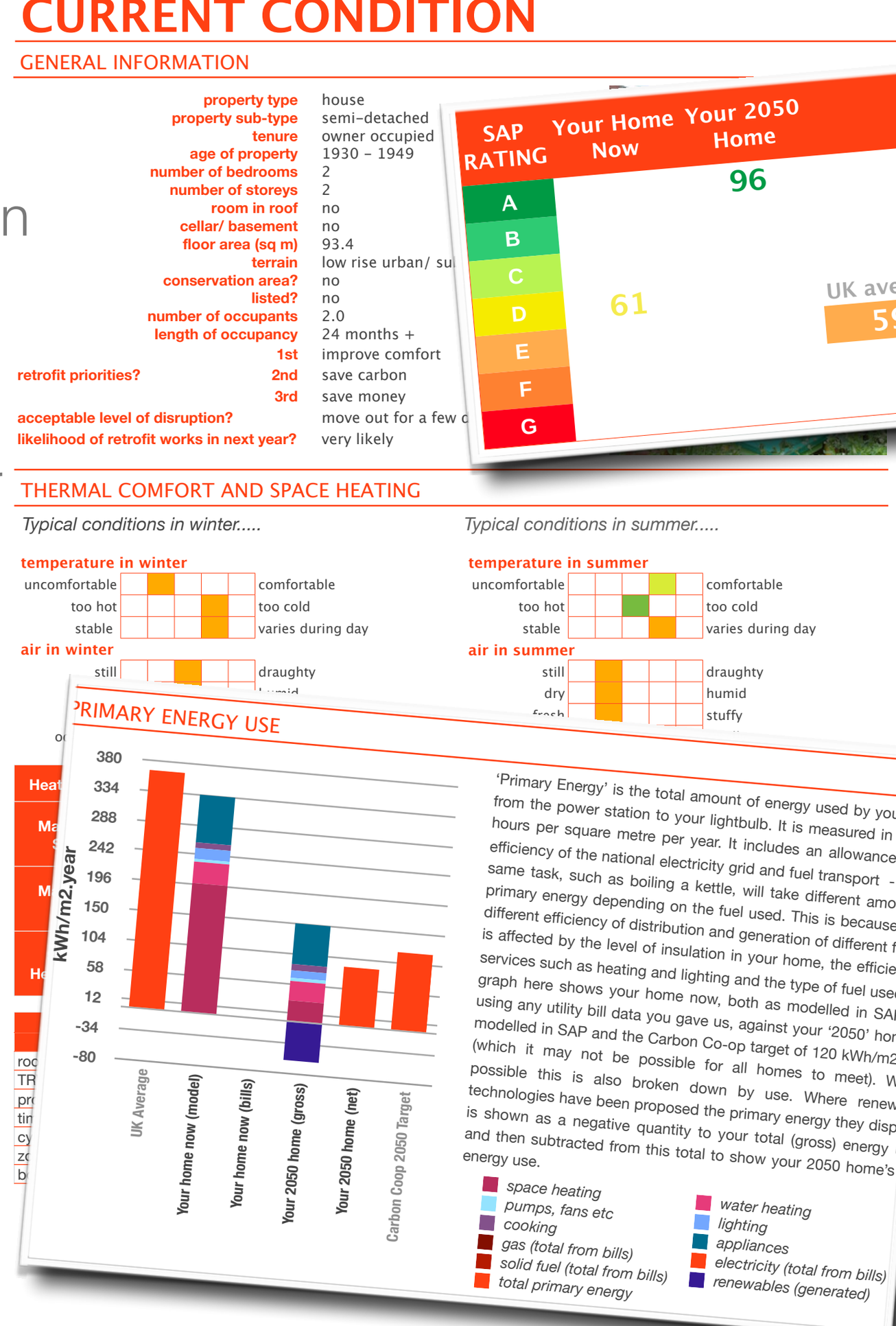

MEASURES • average cost (all inclusive) this week £34,000

The table below outlines the potential measure which could be implemented to achieve the 80% carbon reduction target. Costs are provided for budget guidance only, based on best available information from a quantity surveyor. They are not formal quotes, and actual costs may vary.

BC	measure	benefits	notes		amount	price	total
appliances etc	appliances A++ - dishwasher, washing machine, fridge, freezer	Up to 30% reductions in electricity use in appliance can be achieved, if all appliances are very energy efficient	Dishwaher	£425.00			£1,340
			Washing Machine	£275.00			
			Fridge (undercounter)	£305.00			
			Freezer (undercounter	£335.00			
	low energy lighting - replace all GLS or bayonet bulbs with CFL's and all low energy spotlights and downlighters with LED equivalents	This reduces both power use and maintenance	CFLs		11.0	1.50	£17
			LEDs		8.0	9.50	£76
controls	masterswitches - remote controlled sockets either bypass or replacement sockets	This allows for all the appliances in a room to be turned off at the mains when turing off the lights	Sockets for things like TiVo boxes can be left off the circuit. This does not need to be hardwired there are products such as intermediate plug/sockets that power to be switched off to several remotely		3.0	55.00	£165
	better heating controls such as programmable thermostats, gate valves to create differently programmed heating zones	This allows heating to be confined to areas of the house in use, minimising heating of unoccupied area	The effect of zones will have less effect as the heating needs of the house are reduced however it can be an early measure. Products need to be chosen that allow for easy manual override		6.0	175.00	£1,050
	energy monitor		http://www.efergy.com/index.php/default/products-uk-1/e2v2-wirelesssmonitor-uk.html		1.0	55.00	£55
			basic measures				
	draught proofing - adding draught seals and extra rebate front door	Much heat is lost through draughts	Chimneys can be sealed to if not needed for the design ventilation arrangements, if external these should be filled with granular inert closed pore insulation		94.2	3.50	£330
	sealing timber ground floor	Much heat is lost through draughts	This can be done with mastic on top prior to re-sanding or can be done with air seal membrane and tape while fitting insulation beneath.		32.0	6.00	£192
	increase loft insulation to an overall depth of 400mm of high recycled content glass wool to achieve U-value of 0.1W/m^2K^{-1}	Cost effective reduction in heat loss while allowing vapour permeability	If used for storage and the rafters are inadequate then build up the rafters to enable decking on top of insulation. If adequate then some of the glass wool can be replaced with layer of extruded polystyrene to create deck.		4.0	7.50	£30
servicing	high efficiency woodburner	flexible focal point heating that reduces CO_2			1.0	935.00	£935
	replace boiler with modern A rated	Even a 10% rise in efficiency has a considerable effect on overall energy performance	The boiler will also need to be sized to suit the much reduced heat losses depending on what the final level of thermal performance is post-retrofit.		1.0	875.00	£875
	design in a passive stack ventilation system making use of existing openings	Improve and stabilise internal air quality while minimising energy use.	Making use of warm air rising to vents in the roof or up existing chimneys, with replacement fresh air being allowed in in a controlled way through humidity controlled vents in windows or up form below the ground floor.		1.0	1,000.00	£1,000
					2.0	90.00	£180

issues:

- there's a wild variation in what people think of as comfortable
- > so we need to make sure the numbers stack up

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issues:

some people are threatening their health through under-heating

> so we need to tailor measures to households not houses

urbed

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issues:

a lot of houses have damp & mould issues

> make sure that things work and we can prove it

urbed

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issues:

- Up to 60% of energy efficiency savings already made through behaviour change

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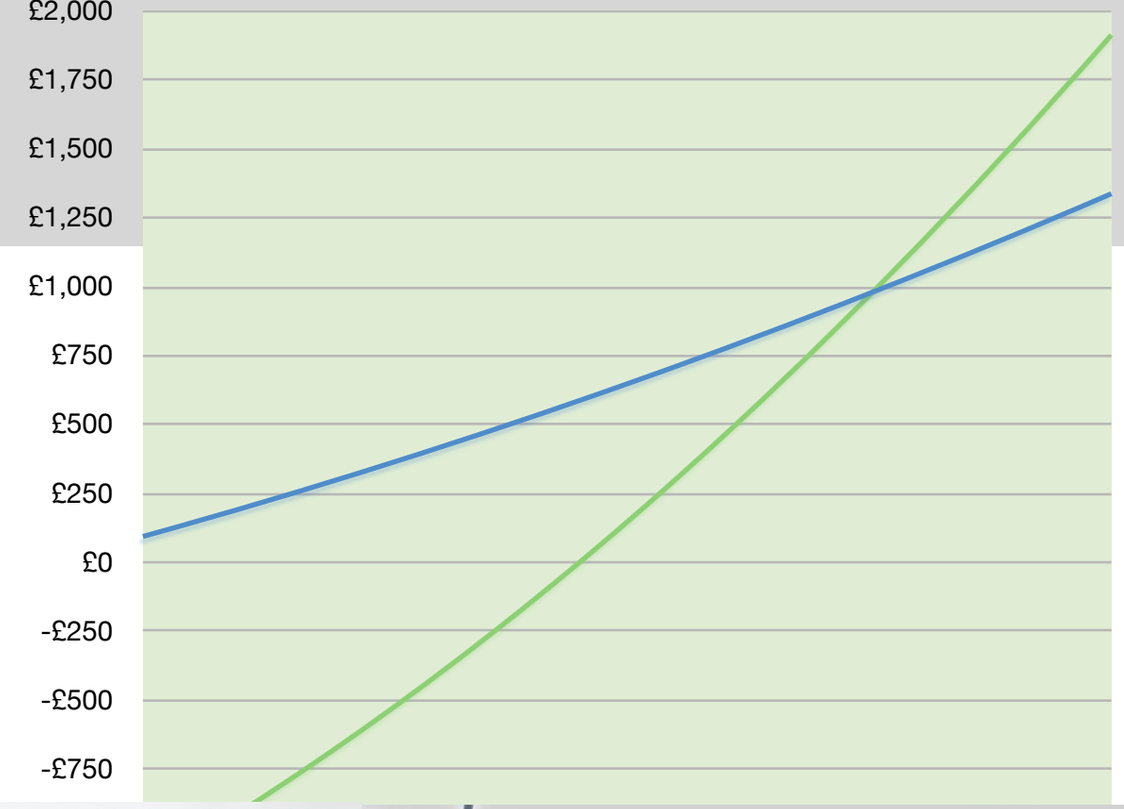
Actual Pay As You Save



DECC ‘go early’

- 14 houses
- all to the 2050 ERT
  (17kgs $CO_2/m^2/A$ + 120kWh/m^2/A)
- using interest free loans
- + ECO (?!**☹!Ω)
- costs between £50k & £22k
- some householders £7pw better off through to £10 worse off

show houses already on site

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- 6 of the 10 GM boroughs

Procure PLUS

JACKSON JACKSON
PUBLIC SECTOR AND COMMERCIAL CONTRACT WORK SPECIALISTS

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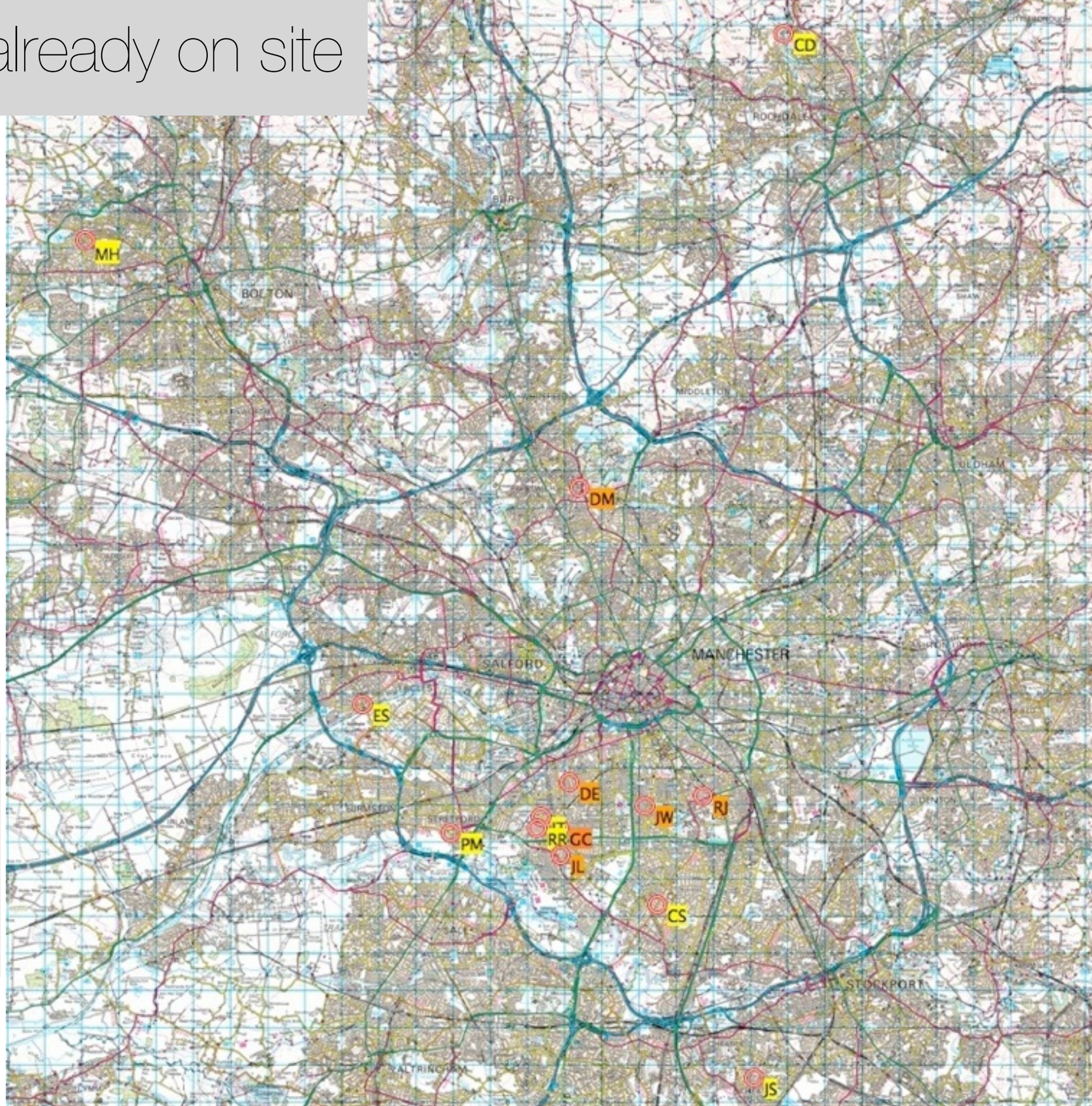


issues:

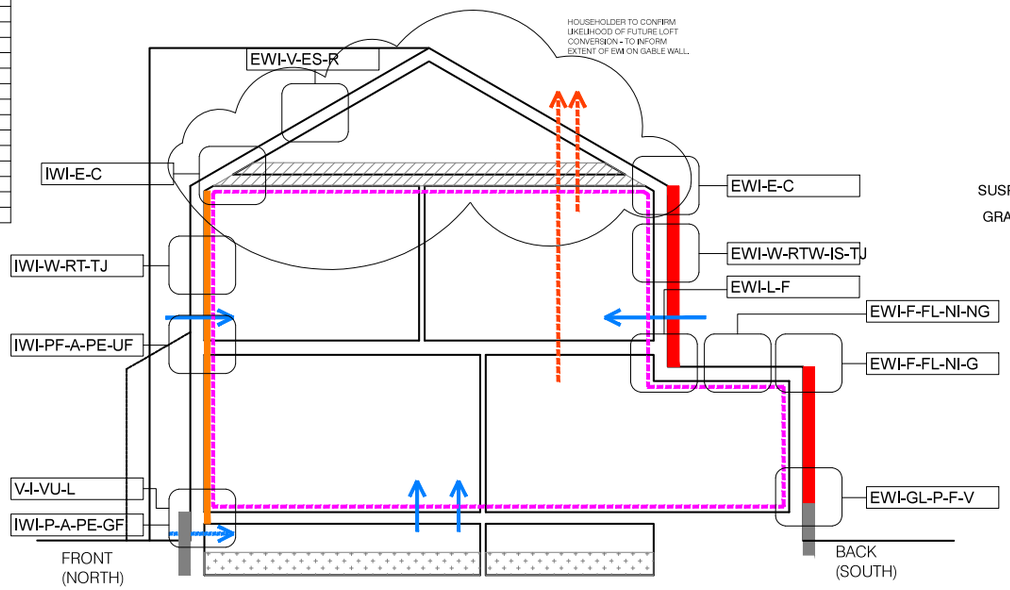
> large amount of expert time is needed

we need a pattern book

with a database to back it up

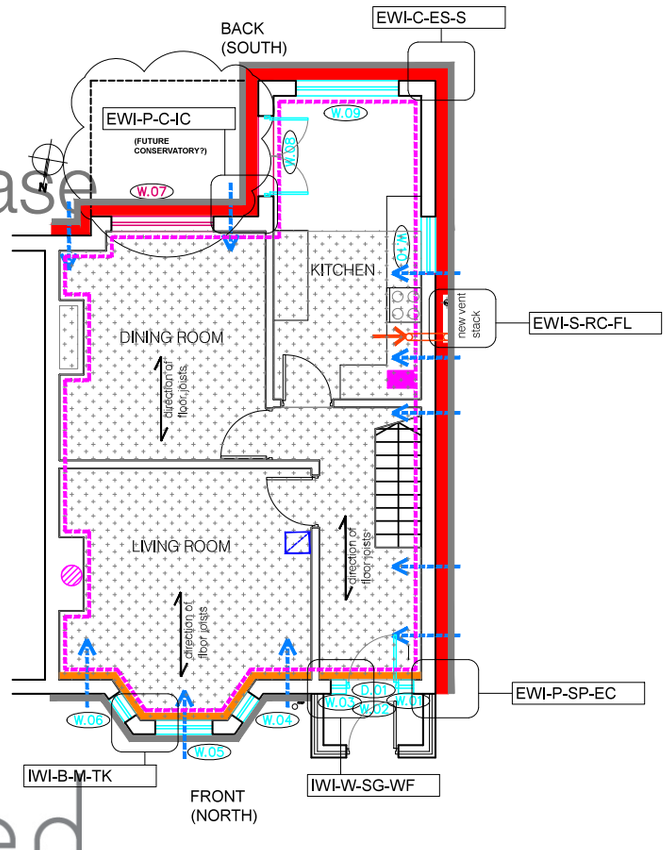
DETAIL SCHEDULE (see specification for full details)

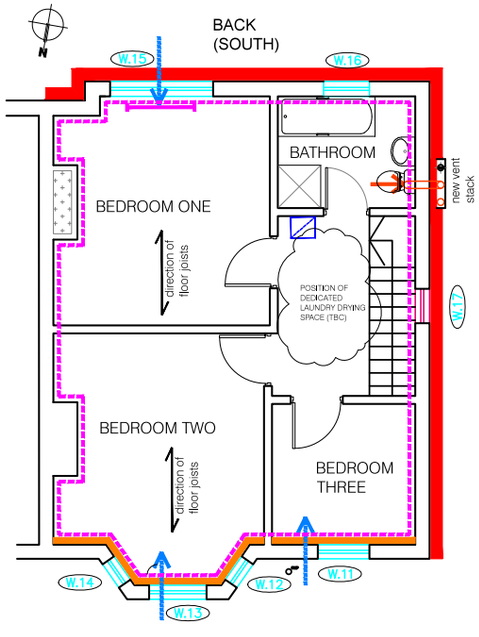
DETAIL CODE	DESCRIPTION
EWI-C-EC-S	EWI to EWI External Corner
EWI-E-C	EWI to clipped eaves
EWI-F-FL-NI-G	EWI to flush flat roof with gutter
EWI-L-F	EWI to lower flat roof
EWI-P-C-IC	EWI to EWI Internal Corner
EWI-V-ES-R	EWI to slate roof verge
EWI-W-RTW-IS-TJ	EWI to retained window
IWI-B-M-TK	IWI to masonry bay with thick mullions
IWI-E-C	IWI to clipped eaves
IWI-PR-A-PE-GE	IWI to perimeter EWI
IWI-W-RT-TJ	IWI to retained window
IWI-W-SG-WF	IWI to secondary glazing within frame
V-I-VU-L	IWI to vent floor with perimeter EWI



KEY TO PROPOSED MEASURES

- NOTIONAL AIR-TIGHTNESS LAYER
- EXTERNAL WALL INSULATION (WOODFIBRE)
- EXTERNAL WALL INSULATION (THIN)
- PERIMETER EXTERNAL FLOOR INSULATION
- INTERNAL WALL INSULATION (WOODFIBRE)
- INTERNAL WALL INSULATION (THIN)
- CAVITY WALL INSULATION
- SUSPENDED FLOOR INSULATION/ LOFT INSULATION
- GRANULAR INSULATION (CHIMNEY/ BELOW FLOOR)
- ROOF INSULATION
- NEW WINDOW OR DOOR
- REFURBISHED WINDOW OR DOOR
- VENTILATION - INTAKE
- VENTILATION - EXTRACT
- HEAT - GAS BOILER
- HEAT - ROOM WOODBURNER
- HEAT - WOODBURNER WITH BACK BOILER
- HEAT - RADIATOR
- HEAT - THERMAL STORE
- HEAT - SOLAR THERMAL PANELS
- PHOTO-VOLTAIC PANELS
- MASTERSWITCH





HEATING ZONES:

ZONE 1: GROUND FLOOR

ZONE 2: FIRST FLOOR

EXTRA/OVER WORKS:

- HOUSEHOLDER REQUEST: ALLOWANCE TO BE MADE IN EWI FOR FUTURE CONSERVATORY AS SHOWN TO REAR.
- NEED TO RE-POSITION CURRENT THROUGH-WALL CAT FLAP
- REGULARISE/ RATIONALISE RAINWATER AND DRAINAGE GOODS.
- ANY NEW KITCHEN/ BATHROOM TAPS TO BE EASY GRIP OR EASY TO MANIPULATE.

OUTSTANDING QUERIES:

- EXISTING WINDOW MANUFACTURER/ SPECIFICATION DETAILS , TO INFORM DECISION ON WINDOW RETENTION.

PORCH

FULL GABLE EWI

GENERAL SPECIFICATION NOTE:

The aim of this retrofit is to improve the THERMAL PERFORMANCE of t dwelling. ALL INSULATION SHOULD BE CONTINUOUS and closely fitted. Cold bridges should be avoided wherever possible. Care should taken to ensure GOOD AIRTIGHTNESS, in detailing and in site works, t prevent heat loss through leaks and draughts.

EXISTING AIRTIGHTNESS: (TBC) m3/m2.hr @ 50pa

AIRTIGHTNESS TARGET: 5m3/m2.hr @ 50pa

EXISTING SPACE HEATING DEMAND (FEES): 130 kWh/m2.a

TARGET SPACE HEATING DEMAND (FEES): 44kWh/m2.a

REFERENCE SCHEDULE (see full schedule for details)

SPEC CODE	DESCRIPTION
FAB L01	Top up loft insulation to 400mm
FAB L02	New draught sealed and insulated loft hatch with ladder
FAB EW01	Woodfibre ext.wall insulation system w render
FAB IW01	Woodfibre int. wall insulation system w plaster
FAB FL02	Foamed glass pumice below susp. timber floor
FAB FL03	External floor perimeter insulation to footings
FAB W02	replacement triple glazed timber windows in EWI
FAB W03	replacement high performance glazing in exist frames
FAB D03	refurbish external door - new rebate and lining
FAB C01	seal chimney (if not needed for vent), fill with insulation
FAB DP09	Air-tightness improvement works
HEAT 02	new condensing combi gas boiler
HEAT 04	room wood-burning stove
HEAT 06	flue liner
HEAT 09	insulation to pipework
HEAT 10	advanced heating controls: programmer and timer
HEAT 11	heating zone control
HEAT 14	remove existing gas fire
LDRY 01	create dedicated indoor clothes drying space
VENT 01	passive stack ventilation system
HW 02	low flow taps - kitchen to have 'click' over-ride
HW 05	new low-flow shower head
APP 01	master-swicthes to appliance plug-socket circuits

WINDOW + DOOR SCHEDULE (check dims before manufacture)

REF.	WIDTH (mm, s.o.)	HEIGHT (mm, s.o.)	AREA (sq.m)	EXIST. COND.	PROP. COND.	SPEC CODE
W.01	270	450	0.12	SG-W	SC-T	FABW06
W.02	840	360	0.30	SG-W	SC-T	FABW06
W.03	270	450	0.12	SG-W	SC-T	FABW06
W.04	500	1800	0.90	DG-16-P	RG-P	FABW03
W.05	1000	1800	1.80	DG-16-P	RG-P	FABW03
W.06	500	1800	0.90	DG-16-P	RG-P	FABW03
W.07	1780	2500	4.45	DG-16-W/A	TG-W	FABW02
W.08	1400	2000	2.80	DG-16-P	RG-P	FABW03
W.09	1800	1000	1.80	DG-16-P	RG-P	FABW03
W.10	1000	1000	1.00	DG-16-P	RG-P	FABW03
W.11	890	1730	1.54	DG-16-P	RG-P	FABW03
W.12	500	1800	0.90	DG-16-P	RG-P	FABW03
W.13	1000	1800	1.80	DG-16-P	RG-P	FABW03
W.14	500	1800	0.90	DG-16-P	RG-P	FABW03
W.15	1790	1700	3.04	DG-16-P	RG-P	FABW03
W.16	700	1100	0.77	DG-16-P	RG-P	FABW03
W.17	570	1230	0.70	DG-16-P	RG-P	FABW03
D.01	850	2050	1.74	Solid W	Refurb	FABD03

KEY: SG = Single Glazed, DG = Double Glazed, TG = Triple Glazed, SC = Secondary Glazed, RG=Replacement Glazing Units, P = uPVC, W = Timber, A = Aluminium. Number (X-NN-X) denotes glazing cavity on DG in mm.

rev	notes	date	dr by	ap by
original by: MH		02-04-2013		XX

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urbanism environment design
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Manchester, M1 1HR f. +44 (0)161 237 3994 w. www.urbed.coop

Drawing Title:	RETROFIT SCHEMATIC
Project Name:	'GO EARLY' COMMUNITY GREEN DEAL
Client: CARBON CO-OP/ ROSSELSON	SAP ref.: 20130330_Rev D
Site Address: 69 LONGFORD ROAD, CHORLTON, M21 9WP	
Project No.: 852-7-RR	Dwg No.: XXX-XXX / Rev: -
Issue Status: DRAFT	Scale: 1:100@A3 / Date:

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ECO is not fit for this purpose

>it's too complicated

Measures	DER @ each measure	ΔDER	CO	lifetime	in use factor	lifetime CO	
Starting Dwelling Emission Rate (DER)	69.69						
EWI	58.43	11.26	1,427	42	35%	38,947	16%
IWI	53.63	4.8	608	36	33%	14,669	8%
floor	49.66	3.97	503	42	15%	17,957	7%
windows 2.4 > 1.4W/m	45.86	3.8	481	20	15%	8,185	8%
windows 1.4 > 0.8W/m	44.45	1.41	179	20	15%	3,037	3%
doors	43.56	0.89	113	20	15%	1,917	2%
loft top up	40.34	3.22	408	42	25%	12,851	7%
SWI #2 (cold bridges)	37.39	2.95	374	36	33%	9,015	7%
draught proofing	29.18	8.21	1,040	10	15%	8,842	22%
					total qualifyin	107	
					price /tonne	£30.00	
					total ECO	£3,217.06	

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ECO - is this right?

based on inadequate and conflicting calculation methods

		urbed SAP 9.92 combined CO2	stroma RdSAP 9.91 CO2	stroma Full SAP 9.91 CO2	to 3 decimal places?
	equivalent CO2	£90	£105.34	£112.68	
d1	M30 7	103	**84**	**56**	**151.22%**
d2	BL1 5	93	**31**	**66**	**47.10%**
d4	M20 3	144	**176**	**147**	**119.71%**
d5	OL12 6	72	**61**	**40**	**151.90%**
d6	M21 9	72	**31**	**45**	**68.55%**
d7	M32 9	165	**124**	**141**	**87.93%**
d8	M21 9	31	**74**	**48**	**154.25%**
	total lifetime C(	680	581	543	

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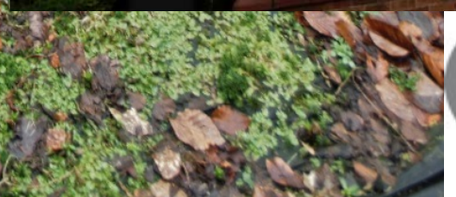
variety of home owners



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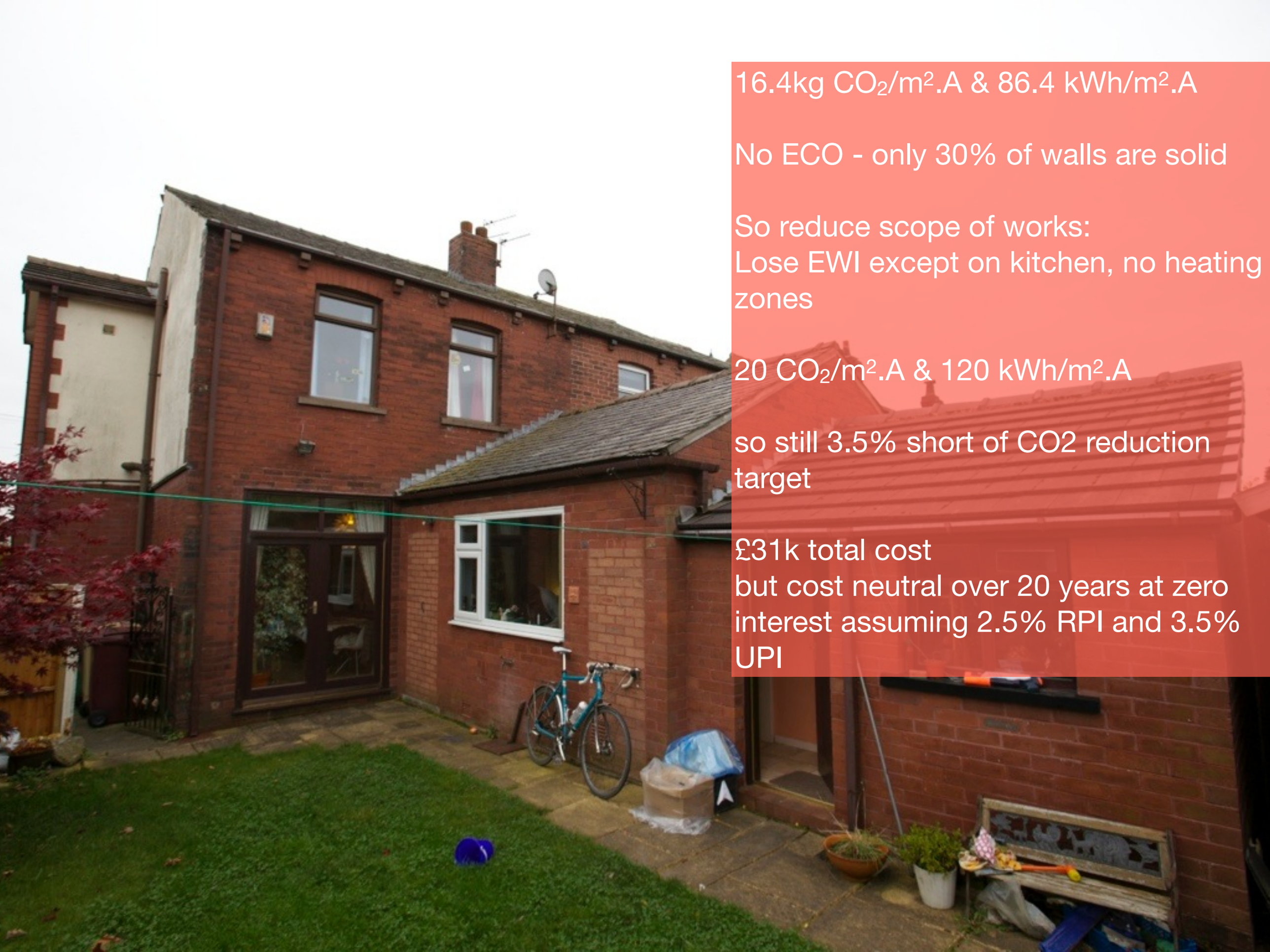
Passive stack ventilation system
5m3 airtightness
draught strip & improve front door
replace small cavity & wooden double glazing
retain 16mm cavity double glazing
insulation under suspended floor
External Wall Insulation (EWI) throughout
Insulate roof at rafter level in main roof
Loft top up over outrigger
Ecobead in party wall TBC
New combi boiler,
Heating zones & better controls,
low flow taps, low energy lighting & appliances, masterswitches
4kW Sunpower PV



16.4kg $CO_2/m^2.A$ & 86.4 $kWh/m^2.A$

No ECO - only 30% of walls are solid

So reduce scope of works:
Lose EWI except on kitchen, no heating zones

20 $CO_2/m^2.A$ & 120 $kWh/m^2.A$

so still 3.5% short of CO2 reduction target

£31k total cost
but cost neutral over 20 years at zero interest assuming 2.5% RPI and 3.5% UPI

Replace open fire place with wood burner
Passive stack ventilation system
Draught lobby & 5m3 airtightness
Replace door to outhouse + front door
Secondary glaze feature windows
Replace timber framed single glazed windows
Retain new uPVC double glazed windows
Internal Wall Insulation (IWI) to front
EWI to rear & gable
Loft top up
New combi boiler, remove cylinder
Heating Controls
Low flow taps, low energy lighting & appliances
2.66kW Sunpower PV

17.4kg $CO_2/m^2.A$ & 95.5 $kWh/m^2.A$

126 lifetime tonnes CO_2

Rates too high on 1st stage tender
reduced door + window spec &
removed some of the heating controls

18.92kg $CO_2/m^2.A$ & 103.9 $kWh/m^2.A$

£49k total cost incl. contingeny, fees + VAT
costs neutral compared to this years bills (£10pW extra on last year's)

Remove living room heater
Passive stack ventilation system
5m3 airtightness
Replace front door
Replace all glazing
EWI to whole house to top of footings except extension over carport.
Loft top up, with storage area
New boiler
Heating controls
Low flow taps, low energy lighting & appliances
5.33kW Sunpower PV - (DNO willing)

would like renewable heat but no RHI

zero carbon by current definitions
EPC 104
7.5kg $CO_2/m^2.A$ & 41.6 $kWh/m^2.A$

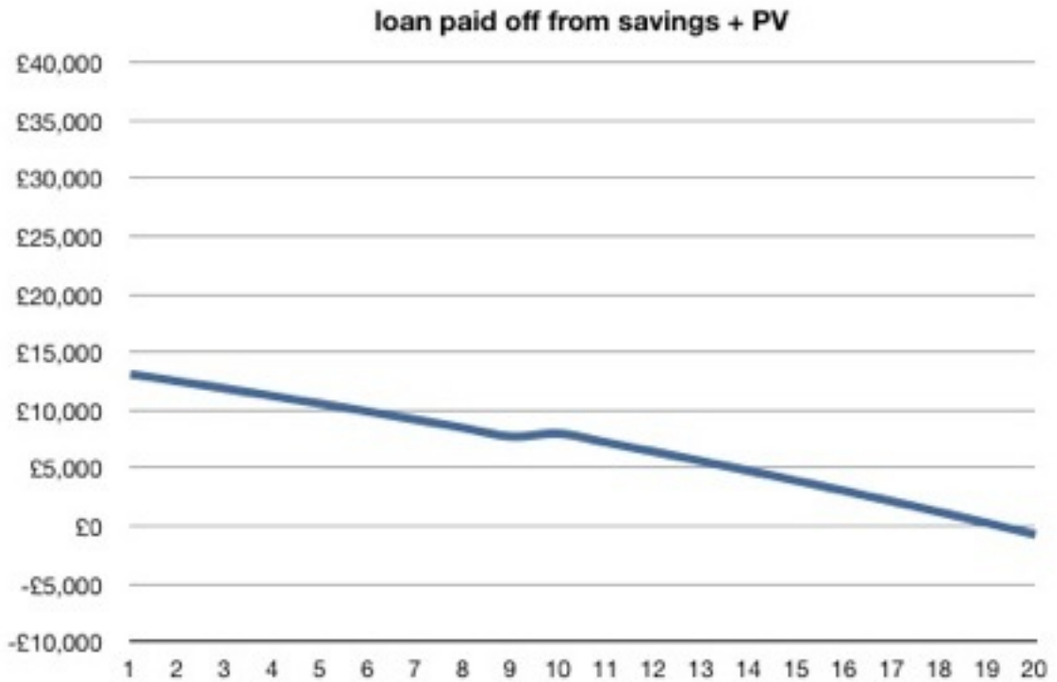
no ECO

£38k total cost
£2/w extra cost

an example householder financial model

financial summary

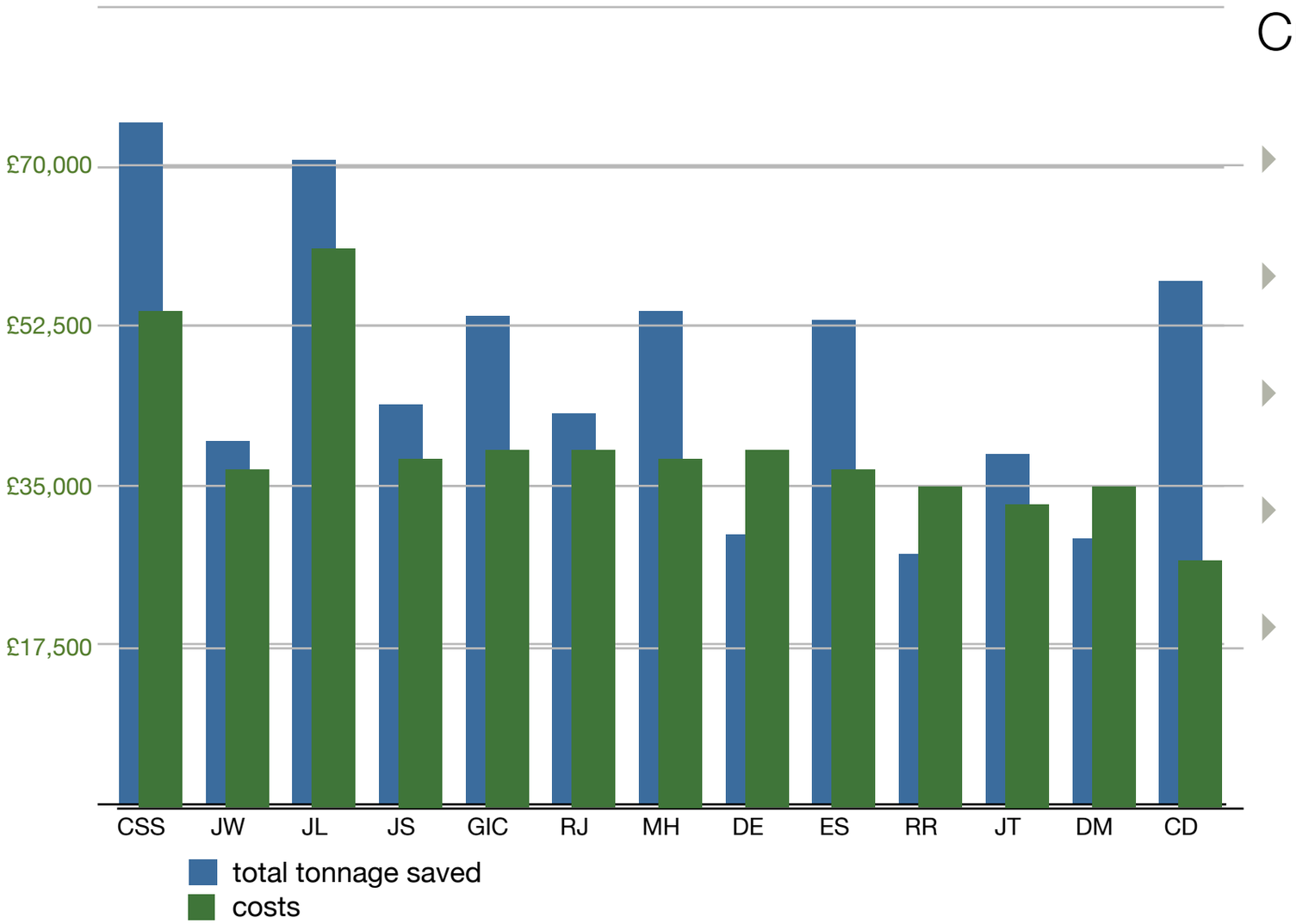
cost of measures incl VAT		£24,420.02		
PV annual yield		2402		
fit income		£357.89		
bill saving from report	modeled	£718.93	actual	£337
PV saving adjustment		£97.16		
total effective 'income'	modeled	£979.67	actual use	£598.06
loan admin costs		£500		
ECO available at		£140.00	/tonne	
	lifetime tonnes	80.117	possible ECO	£11,216.38
financial assumptions				
inflation (RPI)	2.50%	Bank of England assumption		
utility inflation	4.00%	low assumption		
assume used on site	50%	this could be better, but prudent for now		
PV yield decrease	0.40%	/year	0.5% sunpower, 1% mage	
FiT rate	14.9	p/kWh		
export rate	4.64	p/kWh		



cashflow

year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
fit yield	2402	2,392	2,383	2,373	2,364	2,354	2,344	2,335	2,325	2,315	2,306	2,296	2,287	2,277	2,267	2,258	2,248	2,239	2,229	2,219	
used on site	1,201	1,196	1,191	1,187	1,182	1,177	1,172	1,167	1,163	1,158	1,153	1,148	1,143	1,139	1,134	1,129	1,124	1,119	1,115	1,110	
FiT rate (pence)	14.90	15.27	15.65	16.05	16.45	16.86	17.28	17.71	18.15	18.61	19.07	19.55	20.04	20.54	21.05	21.58	22.12	22.67	23.24	23.82	
export rate (pence)	4.64	4.76	4.87	5.00	5.12	5.25	5.38	5.52	5.65	5.79	5.94	6.09	6.24	6.40	6.56	6.72	6.89	7.06	7.24	7.42	
electricity tariff (pence)	12.73	13.24	13.77	14.32	14.89	15.49	16.11	16.75	17.42	18.12	18.84	19.60	20.38	21.20	22.04	22.93	23.84	24.80	25.79	26.82	
FiT income	£357.89	£365.37	£373.00	£380.78	£388.72	£396.82	£405.08	£413.51	£422.10	£430.87	£439.81	£448.92	£458.22	£467.70	£477.37	£487.23	£497.29	£507.54	£518.00	£528.66	
export income	£55.73	£56.89	£58.08	£59.29	£60.53	£61.79	£63.07	£64.39	£65.72	£67.09	£68.48	£69.90	£71.35	£72.82	£74.33	£75.86	£77.43	£79.03	£80.65	£82.31	
bill savings less PV	£31.56	£32.83	£34.14	£35.50	£36.92	£38.40	£39.94	£41.53	£43.20	£44.92	£46.72	£48.59	£50.53	£52.55	£54.66	£56.84	£59.12	£61.48	£63.94	£66.50	
further savings from PV	£152.88	£158.36	£164.04	£169.91	£175.99	£182.29	£188.80	£195.55	£202.54	£209.77	£217.25	£225.00	£233.02	£241.33	£249.92	£258.82	£268.02	£277.55	£287.42	£297.62	
effective 'income'	£598.06	£613.45	£629.25	£645.49	£662.17	£679.30	£696.90	£714.98	£733.56	£752.65	£772.26	£792.41	£813.12	£834.41	£856.28	£878.76	£901.86	£925.60	£950.01	£975.10	£15,425.60
maintenance										£1,000.00											
loan payments	£685.18	£685.18	£685.18	£685.18	£685.18	£685.18	£685.18	£685.18	£685.18	£685.18	£685.18	£685.18	£685.18	£685.18	£685.18	£685.18	£685.18	£685.18	£685.18	£685.18	
annual balance	-£87.12	-£71.73	-£55.93	-£39.69	-£23.02	-£5.88	£11.72	£29.80	£48.38	£67.46	£87.08	£107.23	£127.94	£149.22	£171.10	£193.57	£216.68	£240.42	£264.83	£289.91	
amount per week	-£1.68	-£1.38	-£1.08	-£0.76	-£0.44	-£0.11	£0.23	£0.57	£0.93	£1.30	£1.67	£2.06	£2.46	£2.87	£3.29	£3.72	£4.17	£4.62	£5.09	£5.58	
£1.66																					
deferral model																					
loan balance	£13,106	£12,492	£11,863	£11,217	£10,555	£9,876	£9,179	£8,464	£7,730	£7,978	£7,206	£6,413	£5,600	£4,766	£3,909	£3,031	£2,129	£1,203	£253	-£722	
effective interest deferral		2.57%	2.58%	2.58%	2.58%	2.59%	2.59%	2.59%	2.60%	2.60%	2.61%	2.61%	2.61%	2.62%	2.62%	2.63%	2.63%	2.63%	2.64%	2.64%	

80-90% reductions in energy demand from homes is feasible for pioneers now



Current pilot retrofit average stats:

- emissions: 16.7kg $CO_2/m^2.A$
- tonnes saved 5.4t CO_2/A
- cost: £40,000
- ECO ‘assistance’: £4,000
- nearly meeting golden rule - but this *may* not be the important issue

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on the outside...

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on the inside...

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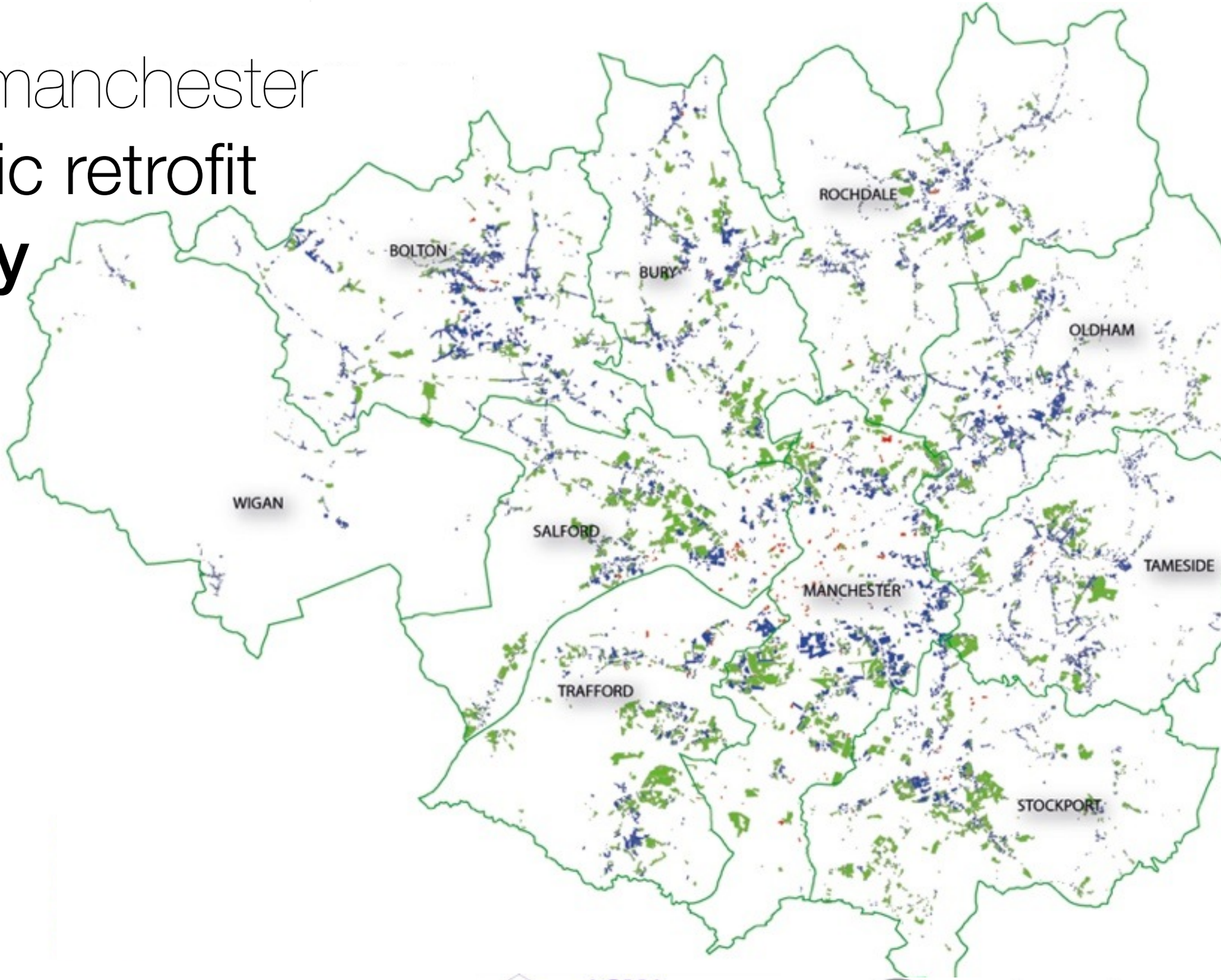
making things fit...

CarbonCo-op

greater manchester
domestic retrofit
strategy

charlie baker
urbed



Low Carbon Housing Retrofit
Greater Manchester

AGMA
ASSOCIATION OF
GREATER MANCHESTER
AUTHORITIES

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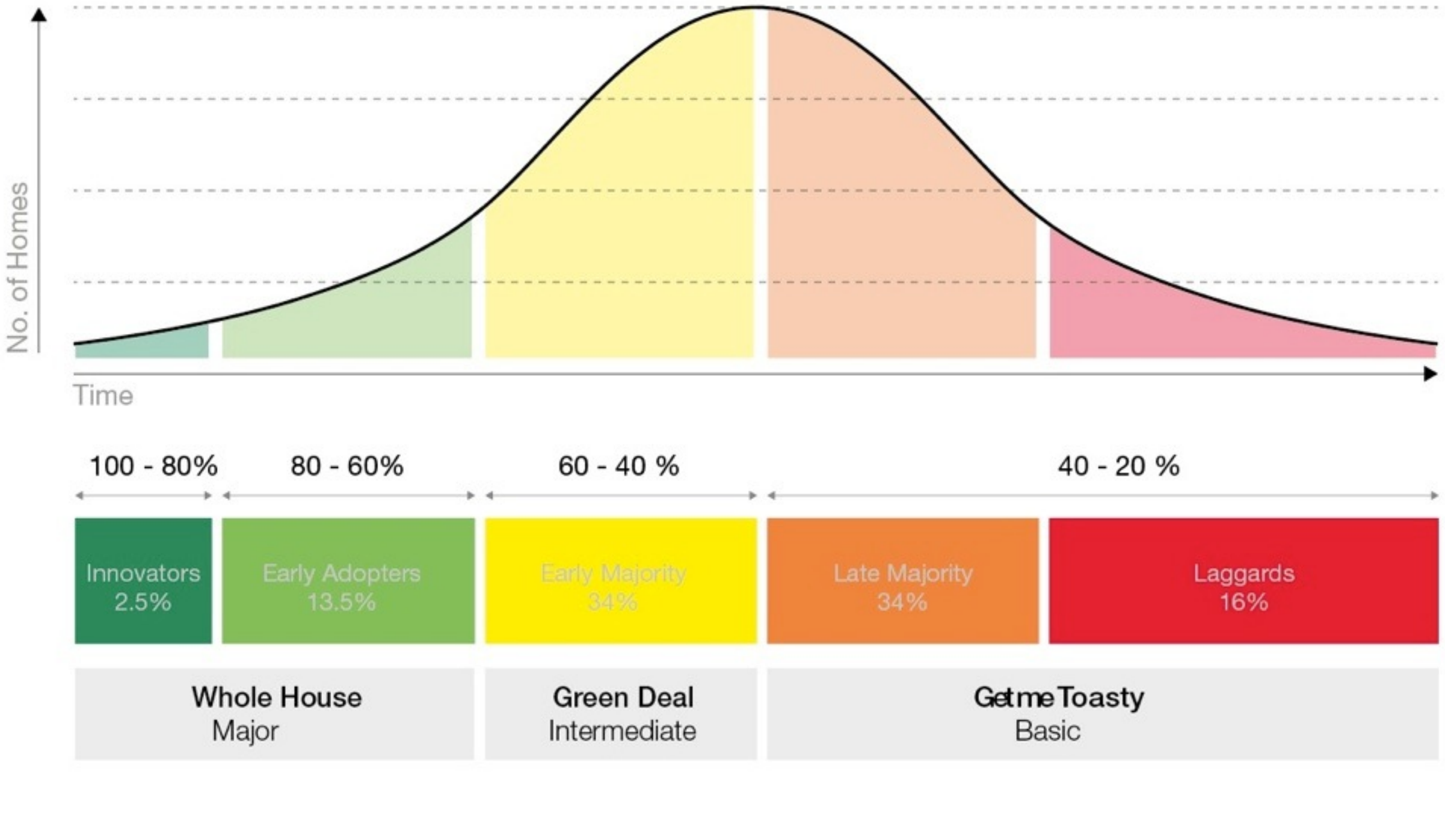
starting with those that want to go now...

- wider marketing strategy
  - influence housing market choices, key points of influence



so that they can help those still not sure yet...

- signing up pioneers + early adopters
  - show homes + testing out detail of packages
  - embedding change in communities

realising the potential

- planned approach to supply chain
- enough certainty to support investment
- diversification & reskilling
- access to high quality products
- identifying new products & methods
- learning needs to be captured & fed back - the GM pattern book
- local Universities & other bodies support development & testing of products

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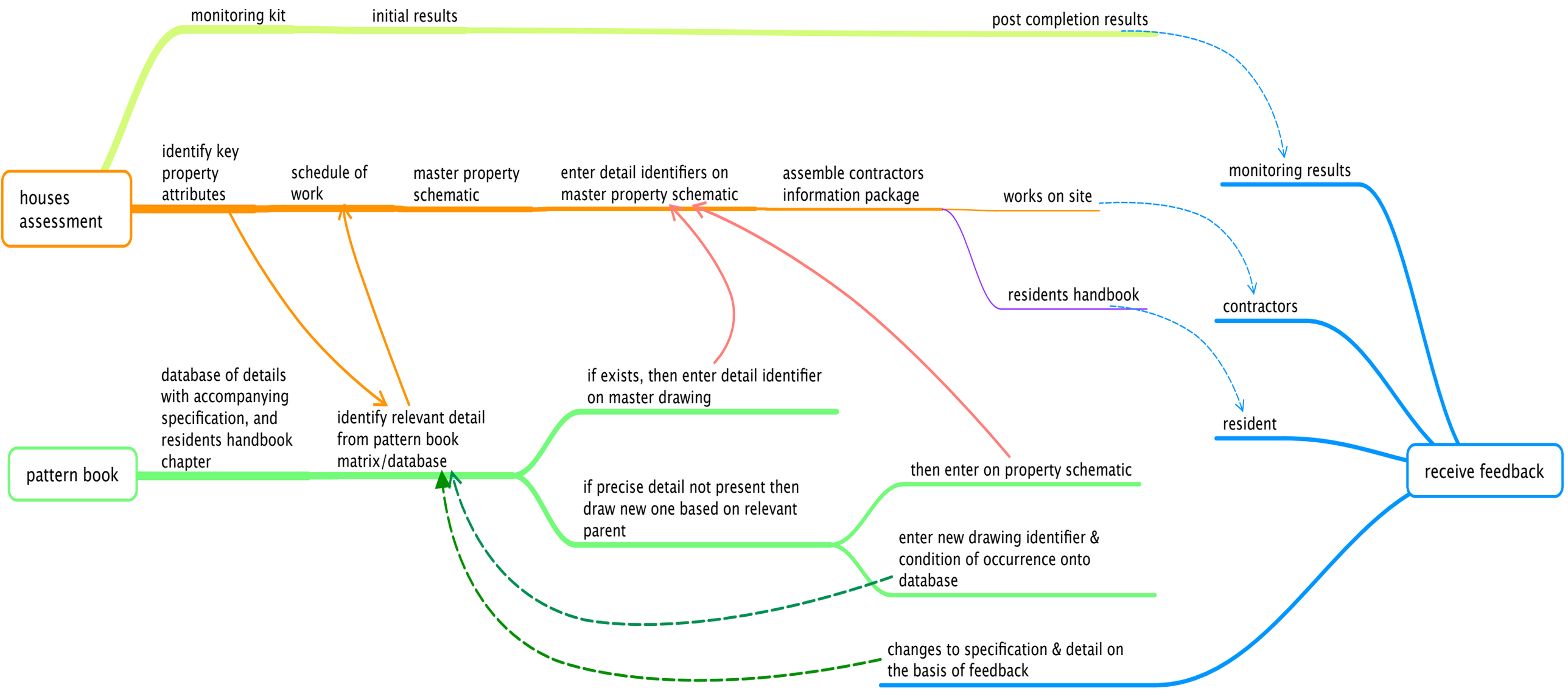
efficiency & accuracy: Self-learning systems & monitoring can speed up evolution of best practice



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Work in Progress

core energy (SAP) calculator now built:

Simple Monthly | Dynamic Coheating | Heating Explorer

OpenBEM

SAP 56 D RATING

230 kWh/m2

DAILY: 22.1 kWh/d

PER PERSON: 17.2 kWh/d

- Floor Area and Volume
- Building Fabric
- Ventilation & Infiltration
- Internal Temperature
- Heat balance
- Energy Requirements
- Export data
- **Retrofit explorer**

Optional modules

- SAP Water Heating gains
- SAP Solar Hot Water gains

Energy requirements

Space Heating		**3844 kWh/year**			+
Supplied by:	Fraction	Demand	Efficiency	Fuel input	
Gas boiler	0.95	3652 kWh/year	90%	4058 kWh/year	
Hot water		**1954 kWh/year**			+
Supplied by:	Fraction	Demand	Efficiency	Fuel input	
Gas boiler	1.00	1954 kWh/year	90%	2171 kWh/year	
Lighting		**203 kWh/year**			+
Supplied by:	Fraction	Demand	Efficiency	Fuel input	
Electric	1.00	203 kWh/year	100%	203 kWh/year	
Appliances		**1247 kWh/year**			+
Supplied by:	Fraction	Demand	Efficiency	Fuel input	
Electric	1.00	1247 kWh/year	100%	1247 kWh/year	
Cooking		**385 kWh/year**			+
Supplied by:	Fraction	Demand	Efficiency	Fuel input	
Electric	1.00	385 kWh/year	100%	385 kWh/year	

Add energy requirement: (enter negative number if generation)

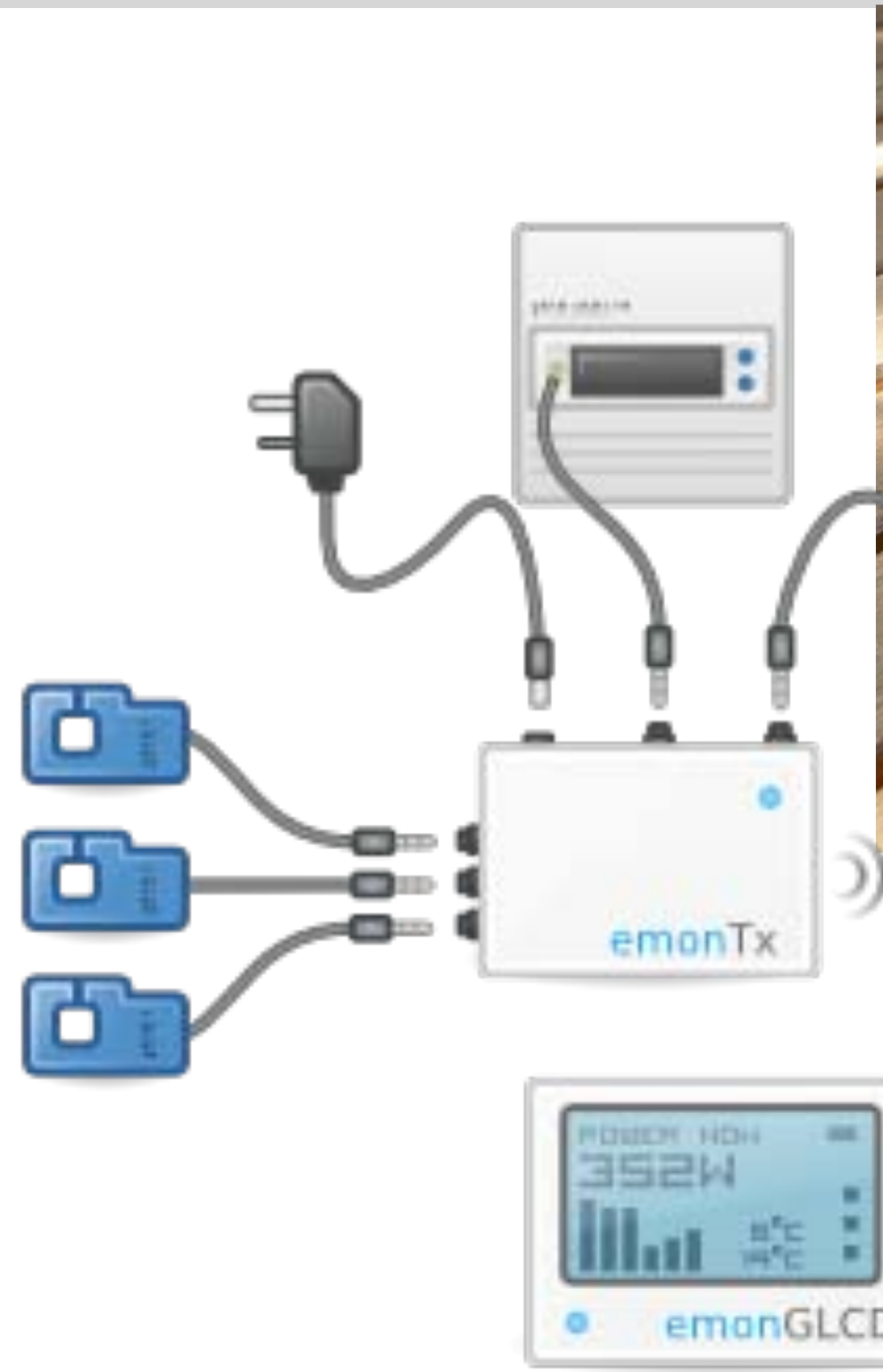
Name: | Quantity: | kWh/year | Add

Fuel requirements:

Fuel type	Fuel quantity	Fuel cost	Annual cost
gas	6229 kWh	£0.04/kWh	£268

CarbonCo-op

post-works monitoring for all, not just a few



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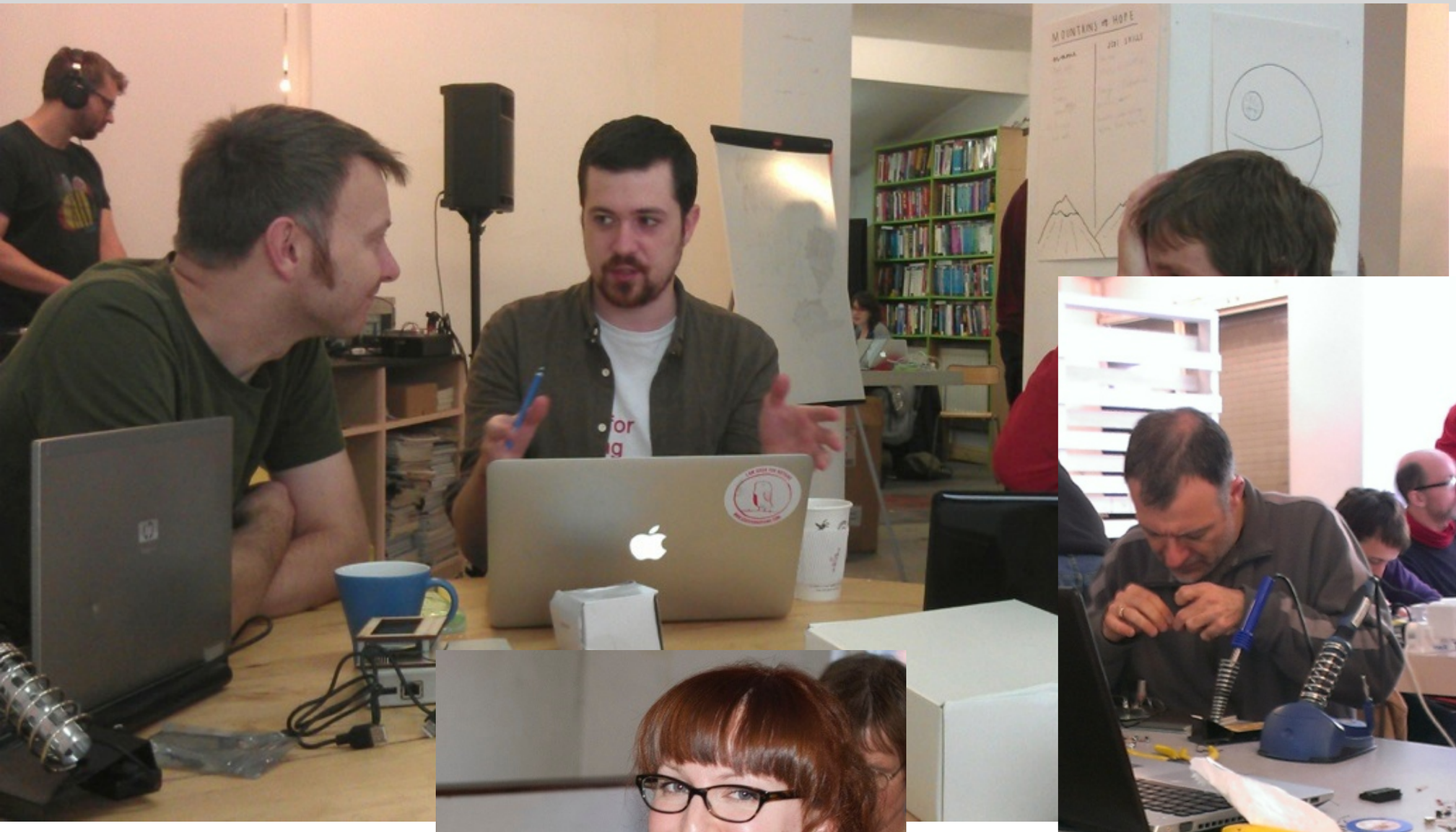
CarbonCo–op

engaging the open-source community: eco home lab @madlab



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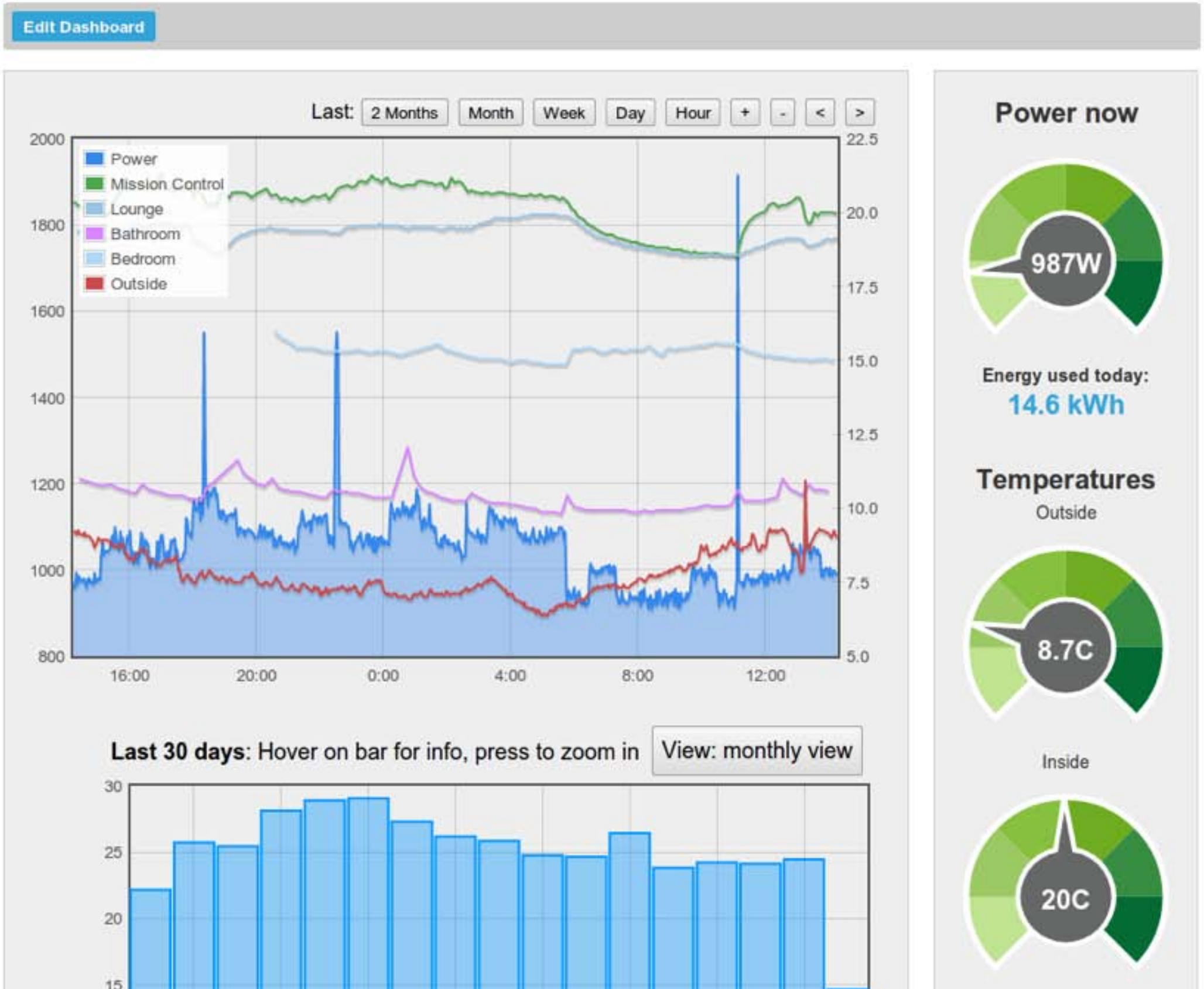
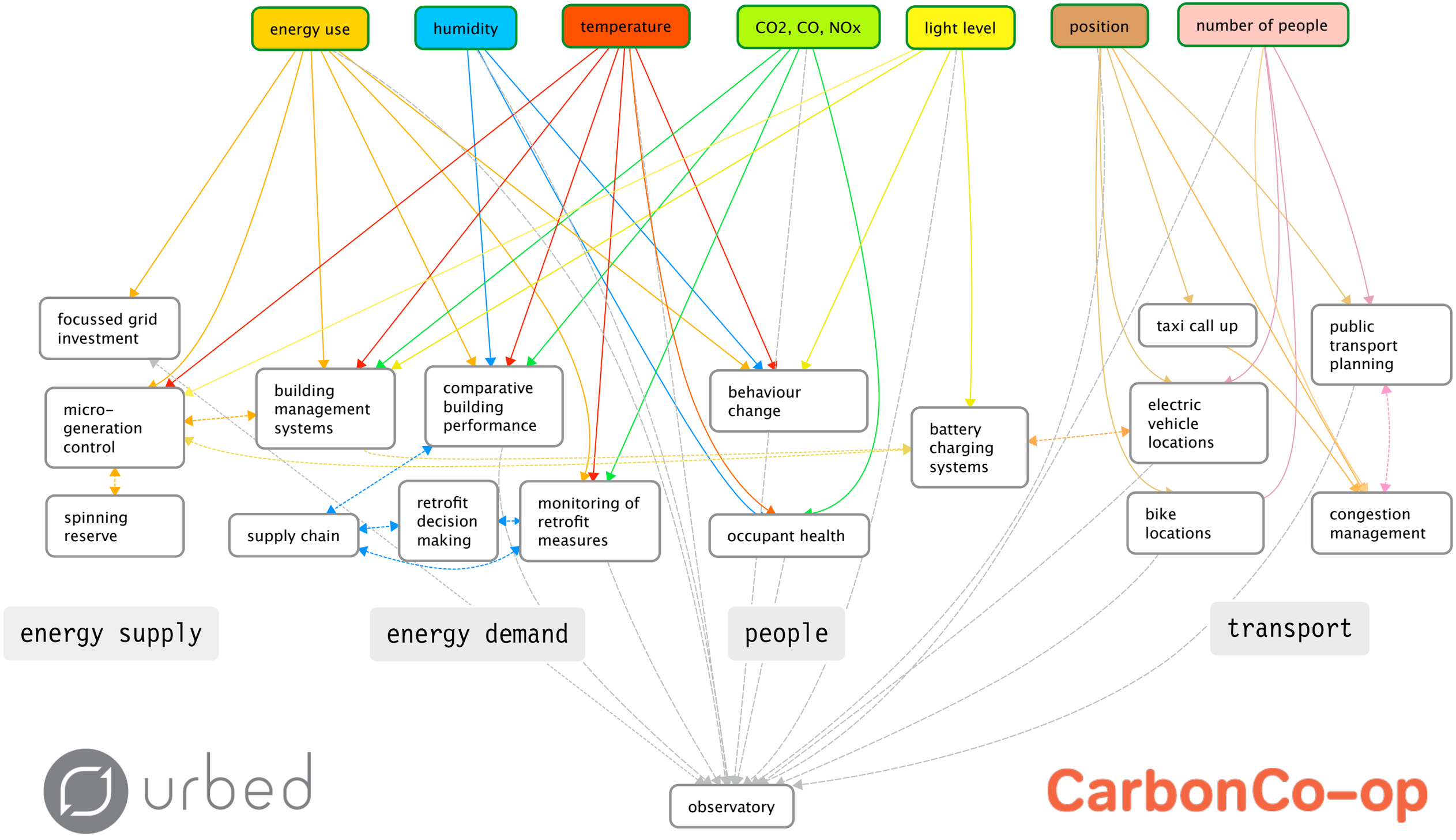
talks to a community of users & suppliers



and this can change how innovation is stimulated, disseminated and rewarded…**future cities?**



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CarbonCo-op

Green Deal for Communities- scaling it up?

supply chain development
contractor accreditation
top level funding?

funding aggregation
neighbourhood co-ordination

community groups
carbon co-op

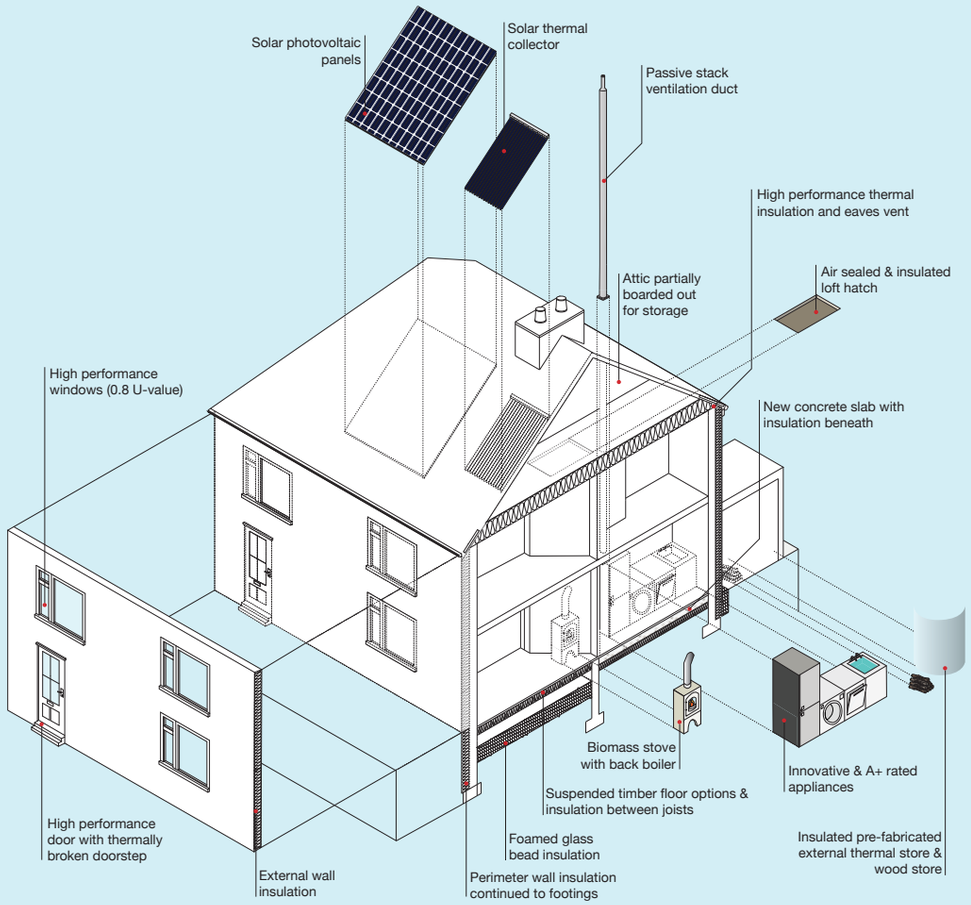
community engagement
whole street delivery

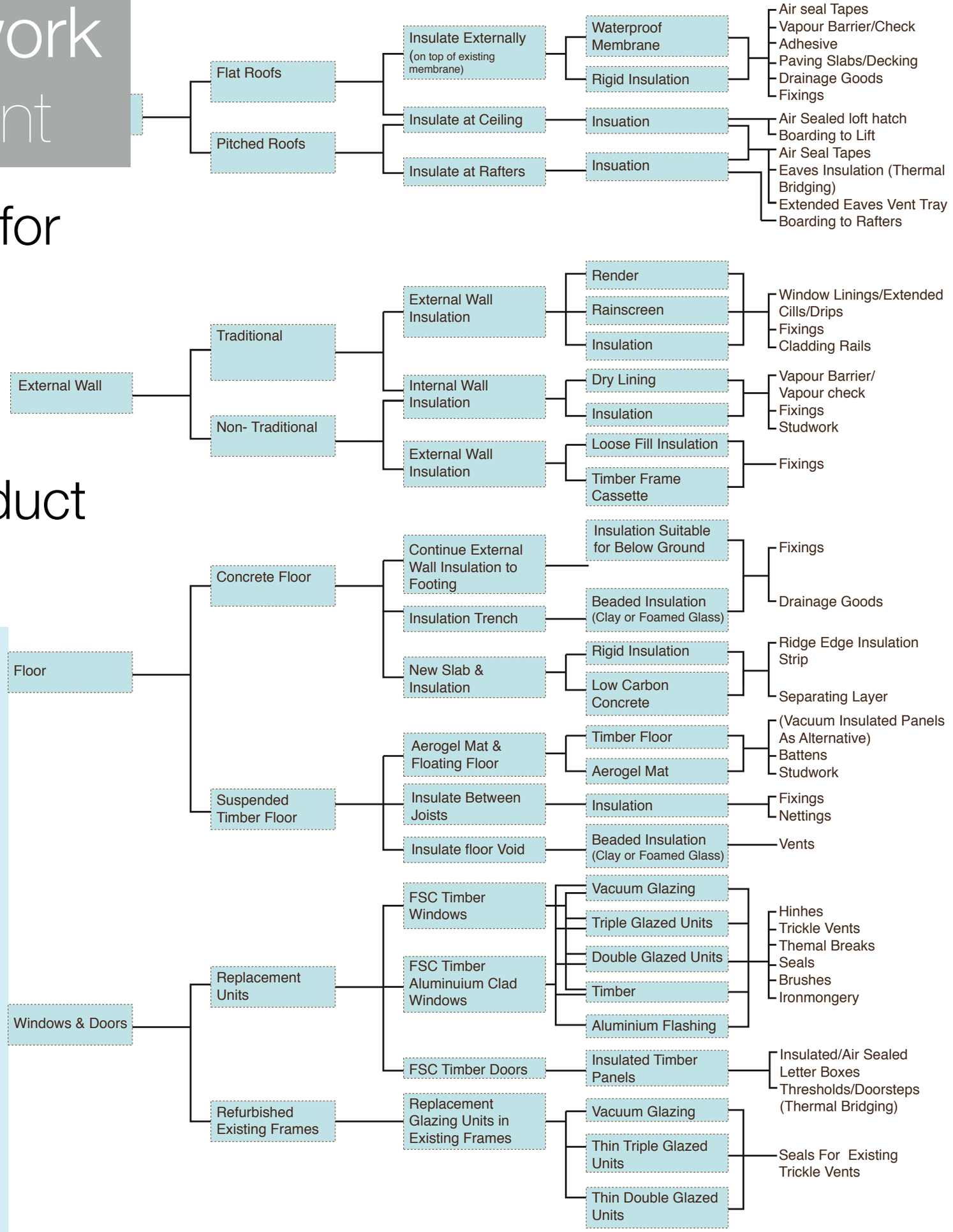
retrofit innovation network - training

- disseminating best practice
- upskilling local capacity
- sharing experience

retrofit innovation network
supply chain development

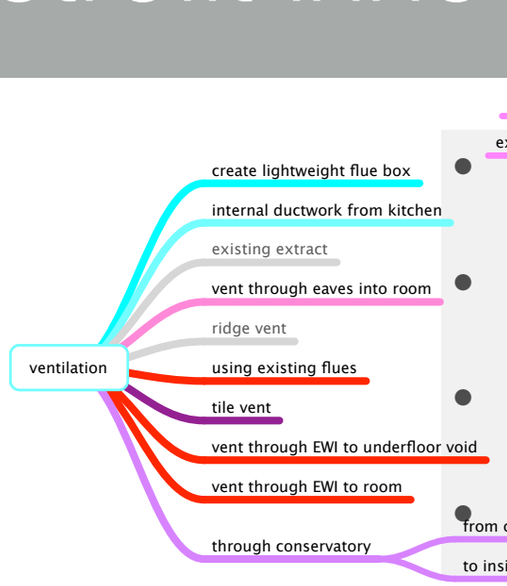
- identifying opportunities for existing industry
- attracting new industry
- encourage targeted product development

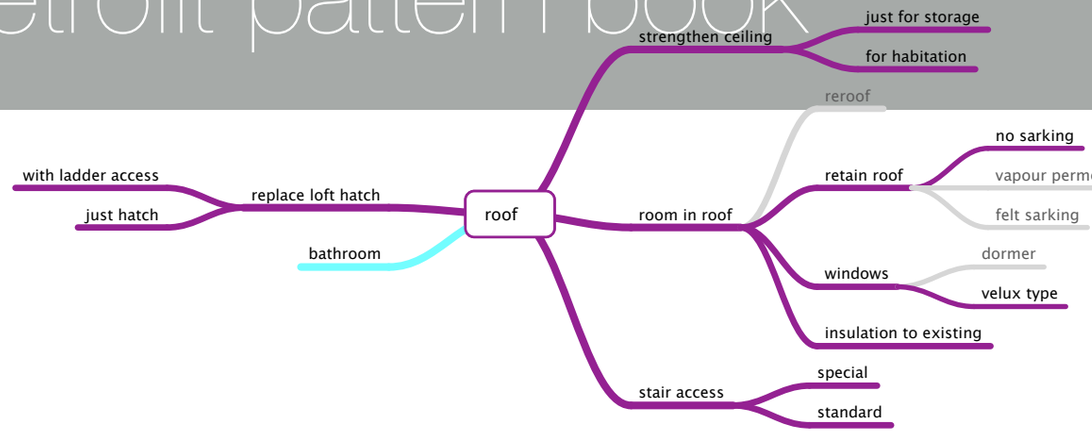


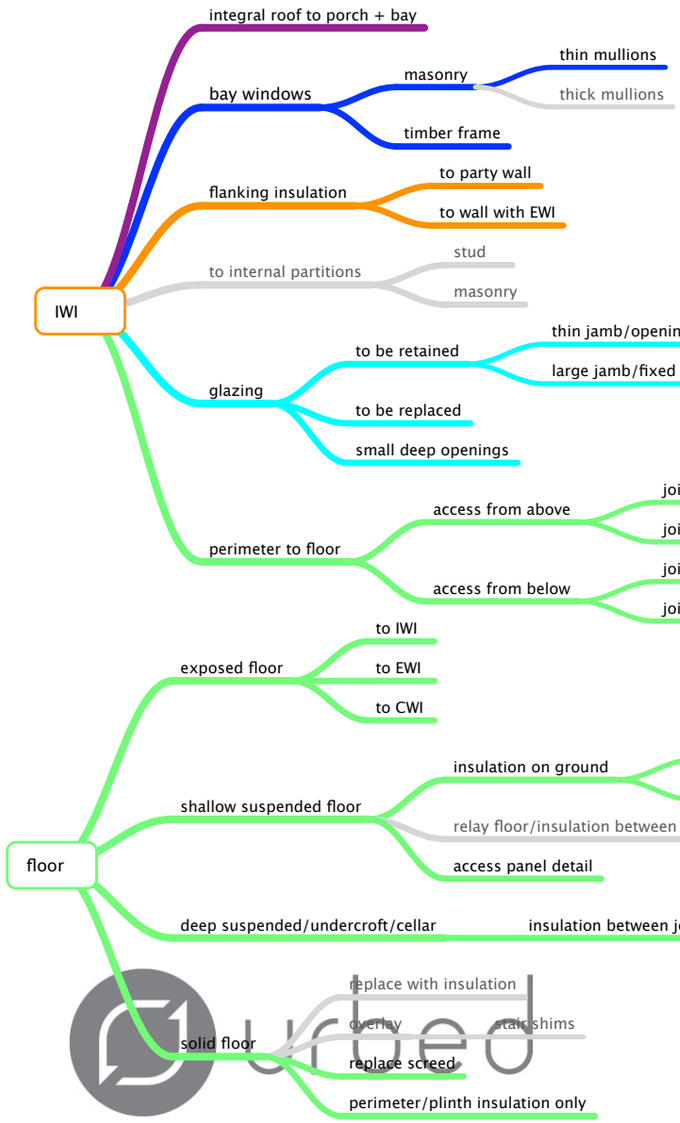


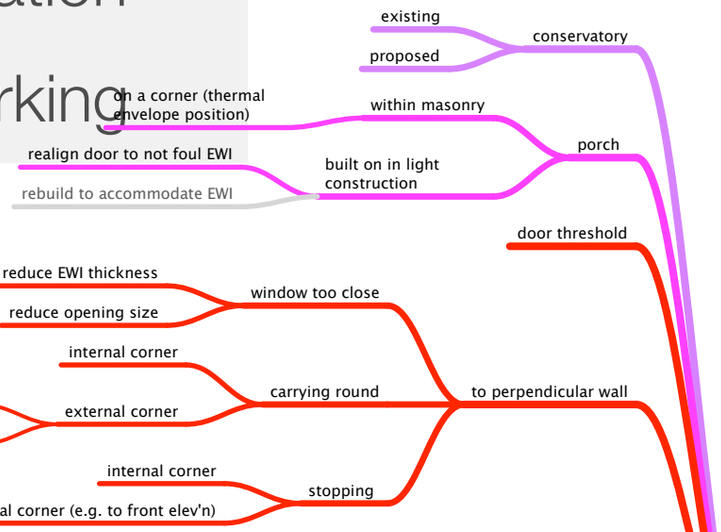
retrofit innovation network - retrofit pattern book

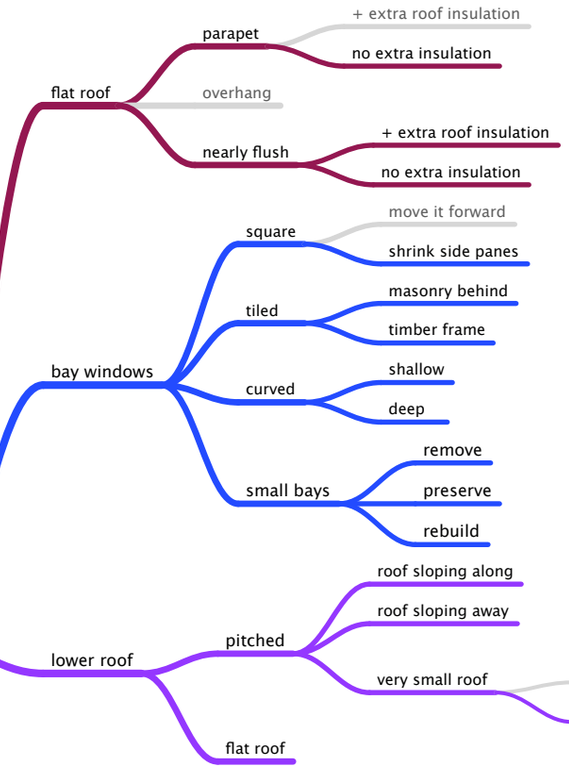
- reduce up front costs
- improve quality
- stimulate innovation
- partnership working

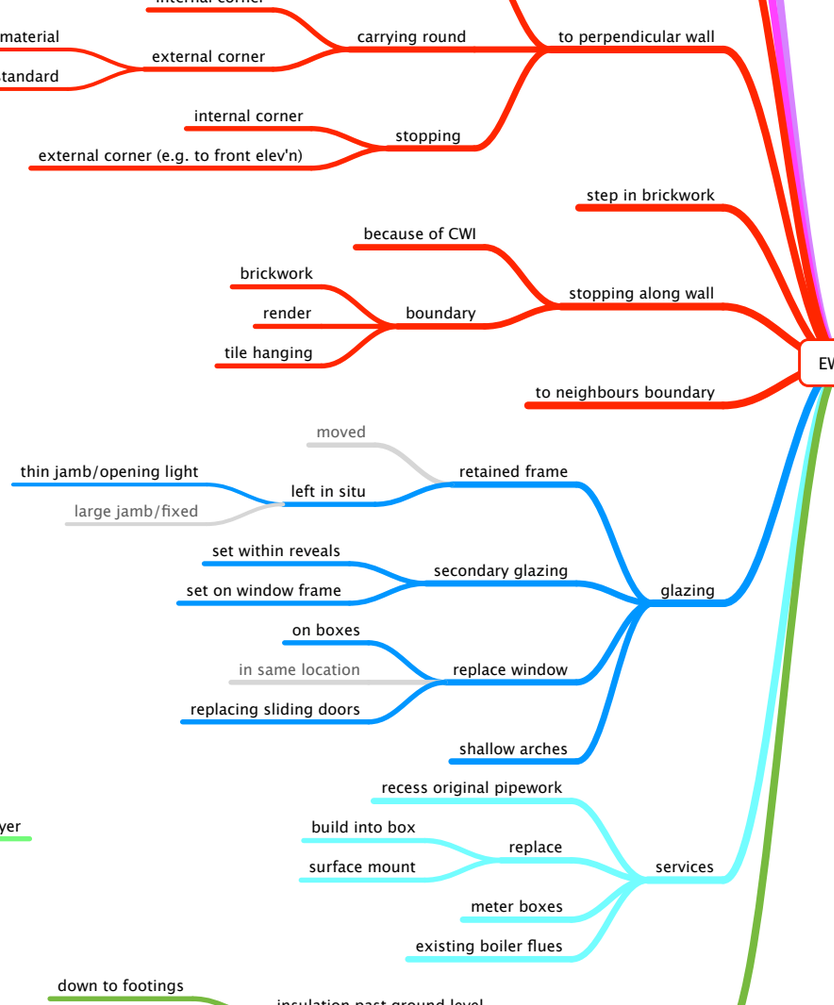












greater manchester domestic retrofit

retrofit innovation network

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